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ARCHITECTS AND BUILDERS

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Illinois Society of Architects
VOL. XIX. 1916



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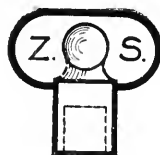
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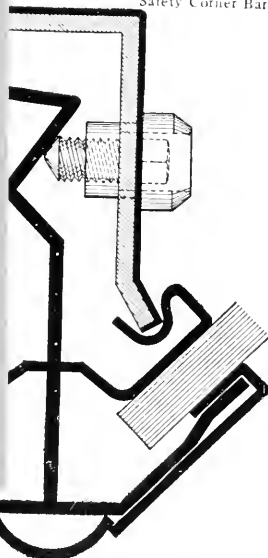
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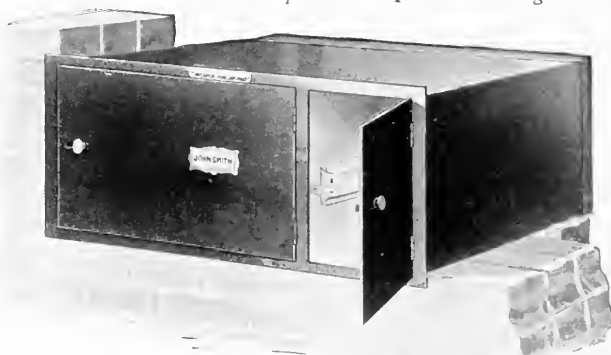
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For

Architects and Builders

Published under the auspices
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1916

NINETEENTH YEAR

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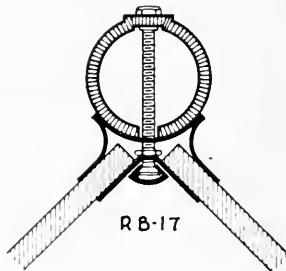
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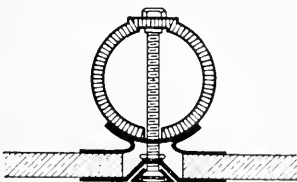


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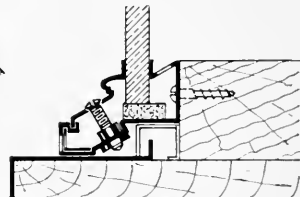
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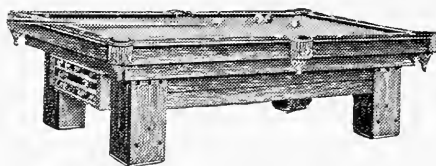
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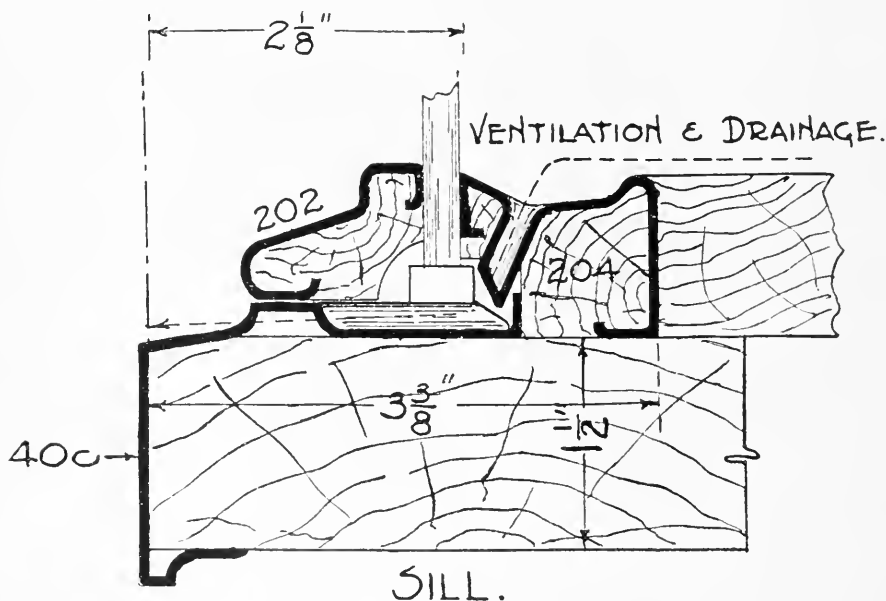
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PREFACE

We beg to place before you the Nineteenth Edition of the "Handbook for Architects and Builders" with the hope that it will meet with the continued commendation and approval of the Architectural Profession of Illinois.

The influence and effectiveness of the Illinois Society of Architects has greatly increased during the past year. It has been our aim to publish this edition in keeping with the progress of the Society. How well we have succeeded remains to be judged by our readers.

The preparation of a publication of this character involves an endless amount of painstaking labor. We think we have exercised diligent care and caution in the editing of the matter herein contained. Notwithstanding this, we must confess that as long as editors are mortal and mortals are prone to err both in accuracy and in judgment, mistakes in statement of facts and faults in judgment as to the selection of matter may have crept in this work. For such faults we ask the indulgence of our readers. Yea, even more, we ask that they forward to us their friendly criticism and suggestion to the end that succeeding editions may be improved thereby.

The same general plan of arrangement that has proved itself satisfactory in former editions is continued in this edition, except that the index to the building ordinances has been moved from the back to the front of the building ordinance. Subject matter republished from previous editions has been carefully revised, corrected and extended. The Building Ordinances have been carefully compared direct from the original minutes of the City Council, and are presented as usual with all amendments printed in italics. These amendments include all actions of the City Council relative to building, up to and including the meeting of July 10, 1916, which was the last meeting before their adjournment for the summer vacation.

All the Special Rulings of the Building Department are published, and while they are not a part of the Code of the City of Chicago, they have been issued as requirements, and will be insisted upon by the Building Department.

These rulings comprise the following subjects: A ruling on Counterbalance of Stairway Fire Escapes, Illuminated and other Roof Signs of Steel Skeleton Construction, Fireproofing of Reinforced Concrete Columns, Caissons, Notes on Reinforced Concrete Design, Bracing of Trusses, Column Walls, and etc., in Steel Skeleton Construction.

Sections of the Sanitary Code of the City of Chicago of interest to Architects will be found in this volume. Also the complete Plumbing ordinances are given in this issue.

The new Rules and Regulations of the Commonwealth Edison Company are given complete.

Prof. W. M. Wilson of the University of Illinois contributes an article on "Wind Bracing in Steel Skeleton Construction." Mr. Arthur R. Lord, an authority on reinforced concrete, an article entitled, "Checking of Flat-Slabs." Mr. Fred J. Postel, consulting mechanical engineer, has revised and extended his article on heating and ventilation, particularly with reference to ventilation; we think the new and revised matter on varnish manufacture, technology of paints and specifications for same will prove very helpful to specification writers. Mr. Oscar Reum contributes tentative specifications covering the technical portion of plaster's specifications; we publish "Standard Specifications" for yellow pine structural timber as adopted by the Illinois Society of Architects and the Illinois Chapter of the American Institute of Architects; Benj. E. Winslow contributes some very valuable additional tables on the strength of reinforced concrete in accordance with the Chicago Building Ordinances; in the Dewey index this year we present a brief outline history of architectural styles from the beginning down to the close of the Gothic period. There has been much complaint on the part of public officials as to the lack of uniformity in practice as to symbols on plans filed for approval. To meet this need we present this year an extended system of plan nomenclature, which is made up by attempting to select from various sources symbols which will be practical for general use.

The Handbook covers a peculiarly exclusive field in this state, which makes it a recognized reference work for every one interested in architecture and building in this locality.

Our Classified List furnishes the architect with a list of those engaged in the manufacture and sale of building material and the contracting business. We have exercised our best judgment in the selection of those represented in our book and we urge architects desiring the names of contractors and material firms to use this list.

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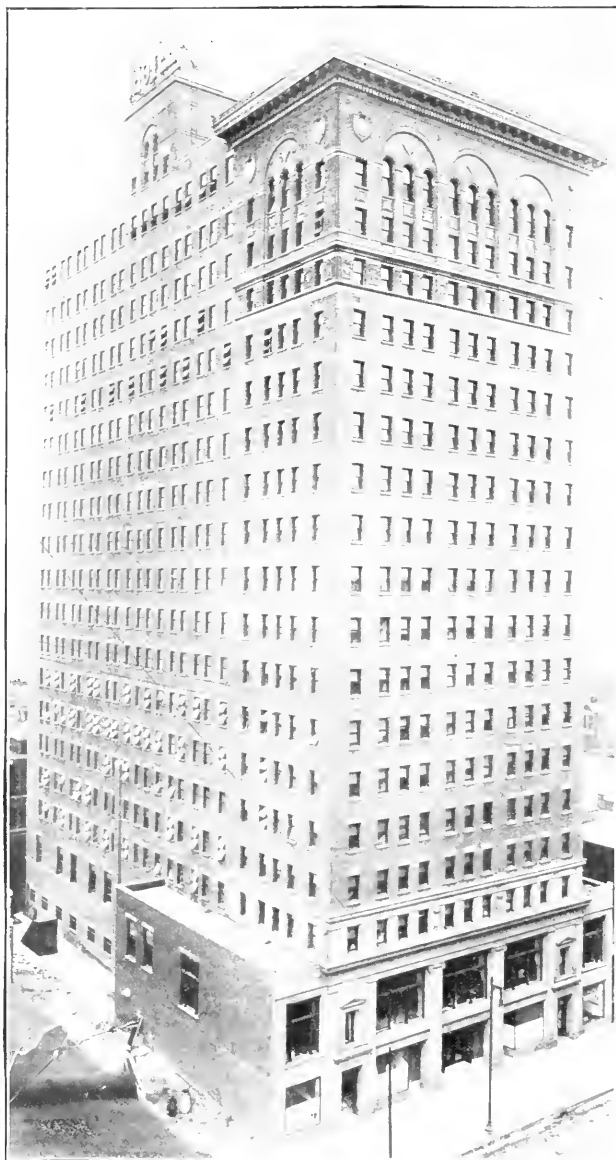
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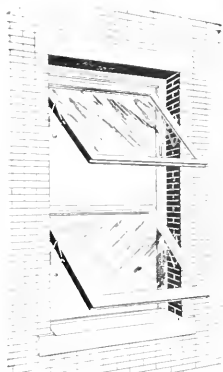
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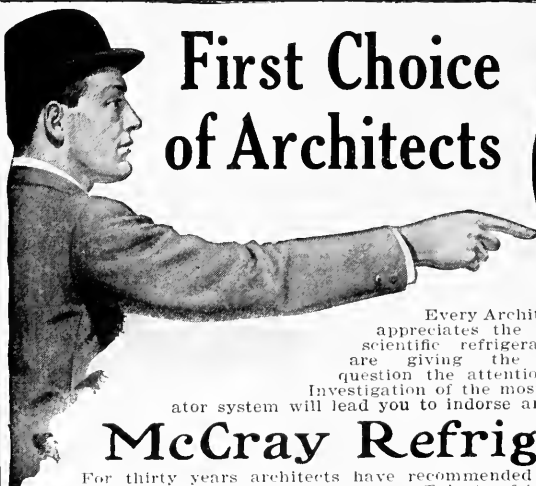


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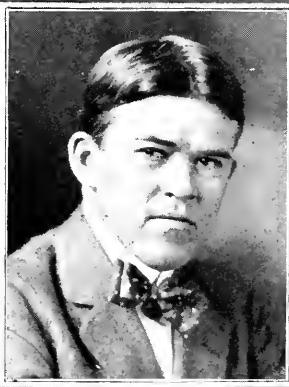
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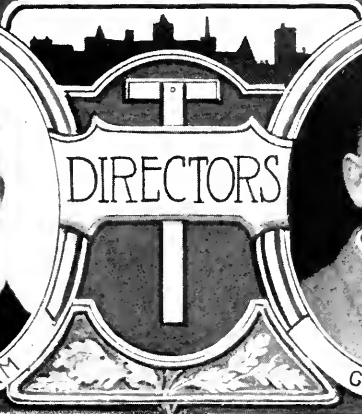
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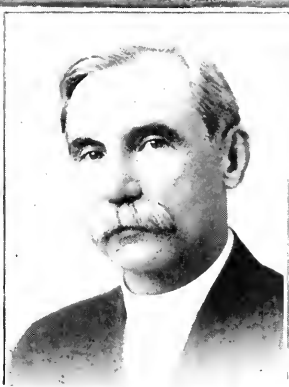
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Type and Size of Pump, Inches	Capacity in G. P. M.	Maximum head in Feet per Stage at 1750 R. P. M.
B $\frac{3}{4}$	5	15
B 1	10-15	27-30
B $1\frac{1}{4}$	25	20
C $1\frac{1}{4}$	35	50
C $1\frac{1}{2}$	50	40
C 2	75	35
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Note: To determine the number of stages required to pump a given quantity against a given head use that number of stages that will develop a head next highest to that required.

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1	1500	$\frac{1}{4}$
2	3000	$\frac{1}{2}$
3	6000	$\frac{3}{4}$
4	10000	1
5	15000	$1\frac{1}{4}$
6	25000	2

Electric Bilge Pumps

Type and Size of discharge	Capacities in G. P. M.
LG 1 in.	10-15
LG $1\frac{1}{4}$ "	25-30
LG $1\frac{1}{2}$ "	50-55
LG 2 "	70-75
LG $2\frac{1}{2}$ "	100-125
LG $2\frac{3}{4}$ "	125-150
E 3 "	200
E $3\frac{1}{2}$ "	300

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LG 2 in.	50
LG 2 "	75
LG $2\frac{1}{2}$ "	100
LG $2\frac{3}{4}$ "	125
E 3 "	150
E $3\frac{1}{2}$ "	250
E 4 "	350

Vacuum Pumps for Heating Systems

No. of Pump	Max. sq. ft. direct radiation	Horse Power motor
1	3000	1
2	16000	$1\frac{1}{2}$
3	25000	2
4	40000	3
5	65000	5



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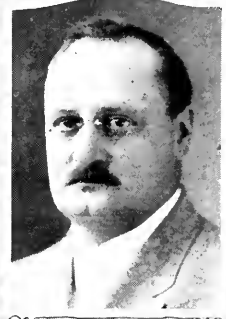
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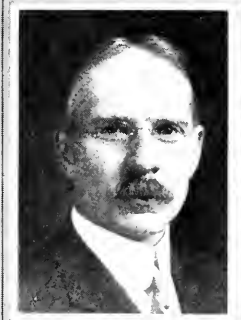


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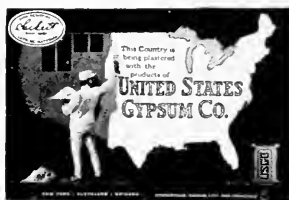
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Organized January 12, 1897. Incorporated June 25, 1897.

EDITORIAL.

A great showman once said, "You can fool all of the people some of the time; some of the people most of the time; but you can't fool all of the people all of the time." He might have added, all of the people like to be fooled some of the time. In this way most people acquire a liberal education—a sort of education that sticks. If we, as architects, are able to give our clients better and more skillful service in connection with their building projects than they can obtain in any other way, then it would seem that we should have little concern about the ultimate preference of our profession. This seems reasonable and logical. Unfortunately, however, logic does not always govern. People do not always know what they ought to know, and if they do by means of their head, they do not always know by means of their heart. The Good Book says that, "where a man's treasure is, there will his heart be also." If this assertion is true, why not the converse, where a man's heart is there will also his treasure be found. This seems to be pretty well proven when the proverbially hard-headed business man is so often willing to listen to any sort of story which promises to tell him how he can get something for nothing. The experience of the United States Government in following up cases of fraudulent use of the mails seems to possibly indicate the attitude of mind of the average business man towards schemes promising disproportionate returns on investments. We are informed by government inspectors that they are constantly discovering victims of all sorts of perfectly absurd schemes—business men who have swallowed bait, hook, line and the pole even, of fraudulent schemes that have been presented to them by not even skillful salesmen. Why? Apparently simply because they wanted to be fooled—they wanted to believe the scheme was all right because it promised dollars for pennies invested. One of the chief difficulties encountered by inspectors in getting evidence against perpetrators of fraud is the fact that a big share of the victims of such fraud are not the poor and so-called ignorant, but are well-to-do business men and women who are too proud to own up to their gullibility, although none the less gullible, and none the less often victimized. The public is getting its education. It is trying the 'red hot stove' method. It is getting its fingers burned. This situation is unfortunate. We, however, may gain profit by careful study of the situation. Why is it that a business man will listen to the glib talking building promoter, who informs him that he can save him the cost of professional service in connection with his building project if he will only turn his building project over to the Hodgepodge Bros. to handle the entire scheme; that he will save the cost of expert service of every sort; that he will not need any architect, lawyer or consulting engineer. No, we agree with the promoter, if he did he would not need any such experts, but he would need a sanity expert. What is his disease? Why, it is heart disease. His heart is set on getting something for nothing, and his brain is too weak to hold his heart in check. Two remedies might be suggested. One would be

to let him burn his heart out. The other method would be to show him the inside of the promoter's scheme—give him a proper perspective—educate his eye to color.

Our problem divides itself into two parts, high standards for ourselves, and public education which will make for a general appreciation of these standards. Who is responsible for the lamentable condition of the public mind as set forth in the foregoing paragraphs? Let us not deceive ourselves. Let us answer the question with brutal frankness. So far as building matters are concerned the fault is with ourselves. We know the faults and idiosyncrasies of our fellow men. We cannot help it. We have them too, but they are always with reference to the other fellow's game. We want money and we want it easy. Our hearts are built that way, and our hearts often get ahead of our heads. That is the reason why we, as a class, go into so many free and unlimited competitions. Somebody tells us that there is a million dollar job to be had for a few feeble sketches; and away we go—poor fools; often spending on a single competition in the aggregate double or treble the entire amount of the commission which would go to one of us if the job went ahead. Alas, the job rarely goes ahead; but if it does, as a rule it usually goes ahead under the guidance of some architect who was not a big enough fool to enter the competition, but was wise enough to have a 'pull' with the owner, and to supplement his weak knowledge of the technical portion of the problem by the information furnished by his job seeking brothers. We cannot afford to shy stones at the fool scheme-swallowing business man when we are just like him; so let us take stock. Our code tells us that it is bad taste, and we know also that it is poor business to try to advertise personal merit. Every man has his weak spot. Every man is, in a sense, an egotist. It is the besetting sin of the human race. No man likes to see egotism in another; and all men are suspicious of the egotist. How shall we go about the problem? Manifestly, we cannot go about it individually. But is there anything to hinder our taking it up collectively? We can see no criticism of this method. In consequence the Illinois Society of Architects has taken steps toward a campaign of education which has as its object the education of the public to the economic and practical value of architectural service. The purposes of such education will in the end be defeated if not based on fact. You may be able to fool a man on almost any scheme once, particularly if that scheme promises large returns, but you cannot fool him twice. Once fool a man, and he forever stands as an obstruction in the way of fooling his friends. If this educational campaign is to count for anything it becomes necessary for us, as individuals, to make good. Why is there a lack of appreciation of architectural service on the part of some people who have had experience? The answer should be apparent. They did not get two hundred cents on the dollar. We all know, of course, that that is what the good architect gives. Possibly they failed to use

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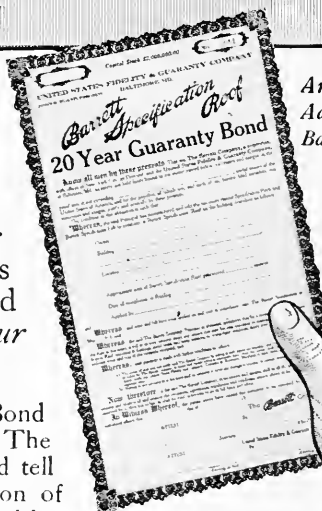
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the right method of selection. May we not hope that the time is not far distant when experts will be selected on the basis of merit, when it will be a case of 'What can you do worth while,' not a case of 'How many votes can you deliver?'—'Who was your grandfather?'—'Does your uncle advertise in my newspaper,' etc. Sick people will no longer consult the banker as to the expert ability of their medical adviser. Legal qualification will no longer be judged by the amount of stock an attorney owns in a newspaper corporation. An engineer's ability will no longer be judged by the millions of watered stock his master corporation has issued. And an architect's standing will no longer be rated by the number of social clubs of which he is a member; his ability to lead a cotillion; or to support a 'Ford.' We know that these standards now govern to an alarming extent. We know that much of the criticism which falls on our profession, as well as that of others, is due to the too general use of mistaken standards in selection. We are very ready to tell the public that free and unlimited competitions are inexpedient and unprofitable, both for owner and architect, but we have not succeeded in conveying to the public intelligently the reasons why such are not to their interest. Contrary wise we have been more successful in conveying the wholly erroneous impression that we are a collection of bigoted, impractical high-brows; devoid of practical business acumen; dangerous to be entrusted with the business details of building projects; and only a necessary evil in connection with the decoration of buildings. They judge classes by the representatives of those classes with which they come in contact. If they use wrong standards in selection, they are fairly certain to make wrong selections, and having made wrong selections, cannot fail to come to wrong conclusions as to the character of the profession as a whole. What must we do? Keep the standards high, and keep the public informed as to what constitutes proper standards of judgment. This means that professional societies must enter upon and be patiently persistent in a campaign of education. In this campaign they must have the united support of the profession as a whole, both morally and financially. Campaigns of this sort that are worth while, cost heavily both in time and money. One of the best methods to get the ear of the public is through the press. It costs money to publish a newspaper and the proceeds of the sale of papers are not sufficient to pay the expense of operation. Publishers are not in the business for the love of the dear people. They, like every one else, have their hearts set on making profit. They also are strong minded. They have to be shown that there will be financial returns for any publicity which they may give. It takes time to prepare good, crisp, telling, readable copy. It would be a waste of money to pay for publicity of any other sort. Even the Health Department of the City of Chicago finds it necessary to employ a skilled publicity agent to prepare copy that will get the public's attention to matters in which they ought to be vitally interested. Interested to such an extent that they would seek after it and find it. We expect the public to be alertly interested in public health, but if they are not, and experience shows that they are not, what can we expect with reference to their interest in the justification for, standards and proper practice of our profession. Is it not apparent that what we greatly need to serve our interest is an adequately paid, skilled executive secretary, one who could devote his entire time to the best interests of our profession; a man with a keen insight into the aims and purposes of the profession, and who would lose no legitimate opportunity for their furtherance?

All of these schemes for benefit require money for their execution—money, which, if

wisely expended, will bring in ample returns. Shall the Society undertake such a step in advance, and if it should undertake such an enterprise, would it be able to secure the substantial, unanimous, co-operative support of the profession as a whole, both from a moral and financial standpoint? What is the answer? Will our profession, practically the oldest of all professions, come into its own, read the signs of the time, and take its position beside the other progressive professions; applying a little plain, ordinary business sense to its activities? Under the laws of this state we are required to take an examination to determine our qualifications for entering the profession. Under these same laws we are required to pay an examination fee of \$25.00 and an annual renewal fee of \$5.00; this money being put into state treasury; the justification for such fees, in addition to ordinary taxes which we are compelled to pay as citizens, being that the money derived from such fees shall be used for the protection of the public in the adequate supervision and regulation of the practice of architecture. What is the practice? A small percentage of the money is used for the purposes for which it is intended, and the balance is used for 'pork.' There are now somewhere in the neighborhood of 900 licensed architects in this state, of which nearly one-half are members of the Illinois Society of Architects. A contribution on an average of \$10.00 from every licensed architect in the state would provide an annual fund which could accomplish wonders in the interests of both the profession and the public. What are we going to do about the matter?

The Illinois Society of Architects has had an unusual growth in membership during the past year, having added to its membership 126 new members, an increase in membership of 25 per cent. It has taken a strong, progressive position with reference to the adoption of business methods in the operation of architects' offices. It has recognized that there has been a tremendous amount of waste in the un-uniform manner of the preparation of plans and specifications, and it has interested itself in the securing of the co-operation of contractors, material manufacturers, and architects in the adoption of standard technical specifications covering workmanship and materials in the various topics or trades involved in the construction of buildings. It has only made a beginning, but it would appear that it has taken up a matter of very extended importance. Much of the criticism which has been in a measure justly leveled at architectural practice has been the vague, indefinite and often contradictory character of specifications emanating from architects' offices. While this practice has been sufficiently extended to bring criticism on the profession as a whole, we must assert that we do not believe that the practice can be considered general. Even conceding that all specifications prepared by architects are carefully and wisely prepared, at the same time the lack of uniformity of standard must result in considerable confusion as to ideas of compliance. It also results in a waste of considerable time on the part of the architect in the repeated duplicate preparation of technical specifications, which time might be saved and employed otherwise to greater advantage, both to the architect and his client. These reasons seem to fully justify a movement toward the preparation and adoption of standard specifications.

A word of commendation should be spoken for the extended activities of the officers and the various committees of the Society. It is difficult for the profession, as a whole, to realize to what an extent they are indebted to the men who are willing to give freely of their time and energy toward its interest by serving them in these various capacities.

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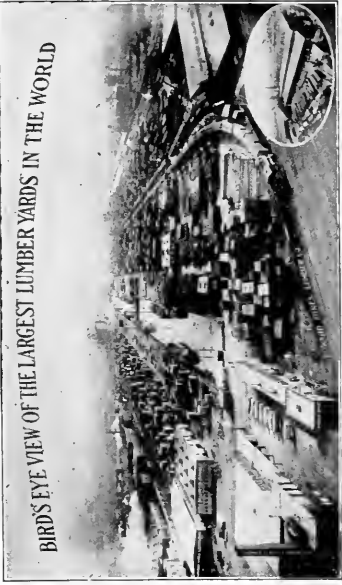
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CANONS OF PROFESSIONAL ETHICS

Preamble.

The architect is engaged in a profession which carries with it grave responsibilities to the public. These duties and responsibilities cannot be met unless the motives, conduct and ability of the members of the profession are such as to command respect and confidence.

The profession of architecture calls for men of the highest integrity, and executive and artistic ability.

The architect is entrusted with financial undertakings where his honesty of purpose must be above suspicion; he acts as professional adviser to his client, and his advice must be absolutely disinterested: he is charged with the exercise of judicial functions as between client and contractor, and must act with entire impartiality, and he has moral responsibilities toward his professional associates and subordinates.

The people of the State of Illinois have a right to expect a high standard of practice and conduct on the part of the architects whom they have licensed to practice. Because an architect is a quasi public official it is imperative that he assume no obligations which shall place official duty and self-interest in conflict.

The Canons of Ethics.

No set of rules can be framed which particularize all the duties of the architect in his various relations to the public, to his client, to the building trades and to his professional brethren.

The following canons of ethics cover certain broad principles which should govern the conduct of members of the profession and should serve as a guide in circumstances other than those enumerated:

I.—On Certain Duties to the Public.

The architect's more important work is of a character so permanent and enduring that he owes it to the public to use his best efforts to make it such as may raise the standard of taste in the community and be in itself a public ornament. He should design with due regard to surroundings and should endeavor to check any individualism, whether in himself or

his client, that is opposed to the public good. He should take part in those movements for public betterment in which his training and experience enable him to give useful service. He should insist on safe and sanitary construction and he should at all times hold the safe guarding of human life and health as of paramount importance to the interests of client, contractor or self.

II.—On the Architect's Status.

The architect's relation to his client is primarily that of professional advisor. This relation maintains throughout the entire period of his service. When, however, a contract is executed between his client and a builder or other person by the terms of which the architect becomes the official interpreter of its conditions and the judge of its performance, a new relation is created. In respect to the matters under contract, it is incumbent upon the architect to side neither with the client nor contractor, but to endeavor, in so far as his action may determine, that the contract be faithfully carried out according to its true spirit and intent.

It is not proper for the architect to assume to act as the owner's agent unless he has been specifically empowered so to act: by so doing he becomes a party to the contract and in a sense disqualified in his judicial capacity.

The fact that the architect's payment comes through the client does not invalidate his professional obligation to act with impartiality to both parties to the contract. It is essential, however, in order to eliminate the influence of self-interest, that the architect shall not enter into any contract with the client which shall condition his payment upon his decisions or advice.

III.—On Preliminary Drawings and Estimates.

The architect should impress upon his client at the outset the importance of sufficient time for the study and preparation of drawings and specifications. If, on the basis of approved preliminary

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sketches, the approximate cost of the work has been mutually considered, the architect should endeavor to bring his working drawings to meet such approximate cost, provided that his client has requested no departure from the original basis of estimate. But at the same time he should acquaint his client with the conditional character of preliminary estimates. Complete and final figures can be had only from complete and final drawings and specifications. If an unconditional limit of cost is imposed before such drawings are made and estimated, the architect must be free to make such adjustments as seem necessary to that end.

IV.—On Superintendence and Expert Service.

On all work except the simplest, it is to the interest of the client to employ an inspector or clerk-of-the-works; in many engineering problems and in certain esthetic problems such as sculpture, decorative painting, gardening and the like, it is to the interest of the client to have specialized expert service. The architect should so inform the client and assist him in obtaining such service. In order to secure unified and harmonious working organization, only such persons should be selected by the owner for consulting experts as shall work in harmony with the architect and shall be approved by him.

V.—On the Architect's Charges.

The schedule of charges of the Illinois Society of Architects is recognized as a proper minimum of payment, but where no other architect is affected it is allowable for an architect to make such an arrangement with his client as is mutually satisfactory. He may not reduce his fee below the schedule of charges in an attempt to supplant another architect; it is reasonable and proper to charge higher rates than those of the schedule when his special skill and the quality of his service justify the increase.

A system of compensation based on the actual cost to the architect on a given piece of work plus an agreed professional fee, has much to commend it.

VI.—On Needless Expenditure.

The architect should scrupulously guard cost, and refrain from introducing need-

less expense or any extravagance in material or construction that may add to cost of building, without compensating gain to the client.

VII.—On Payments for Expert Service.

When retained as an expert, whether in connection with competitions or otherwise, the architect should receive a compensation proportionate to the responsibility and difficulty of the service. No duty of the architect is more exacting than such service, and the honor of the profession is involved in it. Under no circumstances should experts, knowingly, name prices in competition with each other for a given employment. Where governmental regulations prohibit adequate compensation for expert service, it is better to render such service without emolument than to accept a payment out of proportion to the importance of the service rendered.

VIII.—On the Selection of Bidders or Contractors.

The architect should advise his client in the selection of bidders and in the award of contract.

In selecting none but worthy bidders and in advising the award only to contractors who are honest and competent, the architect protects the interests of his client and helps to raise the ethical standard in building.

IX.—On Duties to the Contractor.

On the signing of a contract between owner and builder, the architect is placed in a judicial position and is bound to act with absolute fairness; he is also judge in his own right, deciding whether or not the intent of his plans or specifications is properly carried out, and exercising his judgment as to the true meaning thereof. He should, therefore, take special care to see that these drawings and specifications are complete and accurate, and he should never call upon the contractor to make good his own oversights or errors, or attempt to shirk responsibility by "blanket" clauses.

X.—On Engaging in the Building Trades.

The architect should not engage in any of the building trades, nor should he form any trade partnership or agreement with any person or firm connected therewith:

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nor should he have any financial interests in any building material or device of such a nature as to render his professional action liable to a suspicion of self-interest: If he have any interest in building material or device, he should not specify or use the same without the full knowledge and approval of his client.

XI.—On Accepting Commission or Favors.

The architect may not receive any commission or any substantial service or favor from a dealer, a contractor, or from any interested person other than his client.

XII.—On Encouraging Good Workmanship.

In his authority to interpret and enforce the provisions of the contract, the architect is vested with large powers which he should use with unbiased judgment. While he must condemn bad work, he should also make a point of commending that which is good.

Intelligent initiative, artistic or mechanical, on the part of craftsmen and workmen, should be promptly recognized and encouraged, and the architect should make evident his appreciation of the dignity and importance of their work.

XIII.—On Offering Service Gratuitously.

The offering of professional service on approval, unless warranted by personal or previous business relations, tends to lower the dignity and standing of the profession: also to provide motive for dishonest representation and is to be condemned.

XIV.—On Advertising.

Advertising in any form is to be discouraged as tending to lower the standing of the profession. The presentation of ordinary business cards is a matter of individual taste and not per se improper; but the solicitation of work by circulars or advertisements and the inspiring or inserting of self-laudatory notice in the press are unprofessional.

The best recommendation of an architect is a well-merited reputation for professional capacity and fidelity to trust.

XV.—On Signing Buildings and Use of Titles.

The signing of buildings has the indorsement of the Chicago Architect's Business Association. The use of the initials designating degrees or technical society membership is proper in connection with any professional service and is encouraged as helping to make known the nature of the honor they imply.

XVI.—On Competitions.

In no way does the architect come more conspicuously before the public than through competitions. It is especially desirable that in such circumstances he should conduct himself with self-respect and dignity. To under value and cheapen his service or to compete where a just

award is not safe guarded is inconsistent with this position. Competitions are undesirable from the standpoint of both the client and the architect and a member of the Association should discourage the holding of same. If a competition becomes inevitable, because of governmental regulations, he should not enter either as a competitor or a professional advisor unless the competition is to be conducted according to the best practice and usage of the profession as formulated from time to time by the American Institute of Architects. Except as an authorized competitor he may not attempt to secure work for which competition has been instituted.

He may not present drawings to secure work for which competition has been closed but not decided.

He may not attempt to influence the award in any competition.

XVII.—On the Expert's Future Status.

An architect may not undertake a further commission on any building or work after having acted in an expert capacity in formulating a program which later is put into effect, or after having acted in an advisory capacity in the matter of awards in competition. Having acted in either or both of such capacities should bar an architect from eligibility to execute commissions upon the work in question.

XVIII.—On Criticising the Work of Others.

An architect may not criticise publicly in the press the work of a fellow architect except over his own signature, or editorially; and he may not intentionally injure, directly or indirectly, the reputation, prospects or business of a fellow architect.

XIX.—On Undertaking the Work of Another.

An architect may not undertake a commission while the just claim of a fellow architect, who had previously undertaken it, remains unsatisfied; nor may he attempt to supplant a fellow architect or to obtain a commission after steps have been taken toward the appointment of another architect.

XX.—On Duties Toward the Student Draughtsman.

It is the duty of the architect to advise and assist those who intend making architecture their career. The intending student should be urged to secure a preparation of broad general culture equivalent to that required for the degree of A. B., concurrently with or followed by a thorough course in a well organized school of architecture.

In cases where such preparation is out of the question and the beginner must get his training in the office of an architect, the latter should assist him to the best of



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his ability by instruction and advice. An architect, should, as far as possible, urge his draughtsmen to avail themselves of educational opportunities. To this end he should give encouragement to all worthy schemes and institutions for architectural education.

Members of the society cannot too strongly insist that a thorough technical preparation for the practice of architecture should rest upon a foundation of general culture.

XXI.—On Duties Toward Building Authorities.

The architect should support all federal, state and municipal officials who have charge of matters relating to building and endeavor to maintain or improve the standards of their departments. His quasi public official capacity requires him to show respect for law by careful and conscientious compliance with all building regulations, and if any such appear to him unwise or unfair, he should endeavor to have such regulations altered, but until so altered he should comply with them. An architect because of his official relation to the state and of his moral obligation should not even under his client's instructions encourage any practices contrary to law or hostile to public interests; for he is not obliged to accept a given piece of work, hence he cannot urge in extenuation and to escape the condemnation attaching to his acts that he has but followed his client's instructions.

XXII.—On Professional Qualifications.

The assumption of the title of architect should be held to mean that the bearer has the professional knowledge, both theoretical and practical, and the natural ability needed for the proper invention, illustration and supervision of all building operations which he may undertake.

XXIII.—On Matters Adjudged Unprofessional.

The following code, based on a report of a special committee of the American Institute of Architects, is adopted by the Illinois Society of Architects as a general guide, yet the enumeration of partic-

ular duties should not be construed as the denial of the existence of others equally imperative though not specifically mentioned. It should also be noted that these sections indicate offenses of greatly varying degrees of gravity:

It is unprofessional for an architect—

1. To engage in any of the building trades or to form any trade partnership or agreement with any person or firm engaged therein.

2. To guarantee an estimate or contract by bond or otherwise.

3. To accept a commission or any substantial service or favor from a contractor, or anyone connected with the building trades.

4. To advertise in any form.

5. To enter any competition the terms of which are not in harmony with principles approved by the American Institute, especially if such terms have been specifically condemned by the American Institute or a local chapter thereof.

6. To attempt in any way except as a duly authorized competitor to secure work for which a competition has been instituted.

7. To attempt to influence the award of a competition.

8. To injure intentionally the fair reputation, prospects or business of another architect.

9. To criticise anonymously in the public prints, except editorially, the professional conduct or work of a fellow architect.

10. To undertake a commission while the just claim of another architect who has previously undertaken it remains unsatisfied.

11. To attempt to supplant a fellow architect after definite steps have been taken toward his employment.

12. To offer or perform services at rates lower than those approved as minimum by the Illinois Society of Architects in an attempt to supplant or underbid another architect.

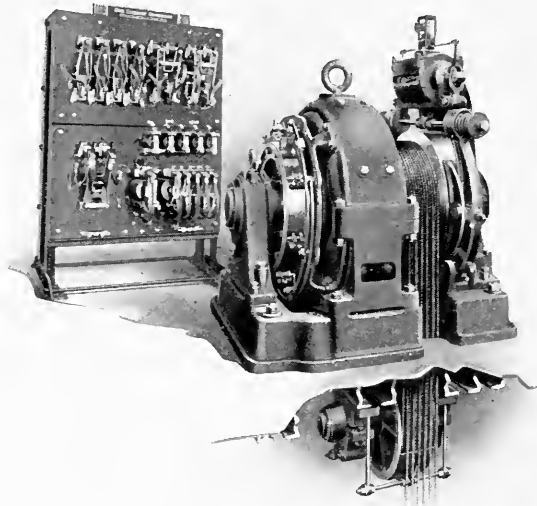
13. To act in a manner detrimental to the best interests of the profession.

SCHEDULE OF PROPER MINIMUM CHARGES AND PROFESSIONAL PRACTICE OF ARCHITECTS RECOMMENDED BY THE ILLINOIS SOCIETY OF ARCHITECTS

1. The architect's professional services consist of the necessary conferences, the preparation of preliminary studies, working drawings, specifications, large scale and full size detail drawings, and of the general direction and supervision of the work, for which, except as hereinafter mentioned, the minimum charge is six per cent (6%), based upon the total cost of the work complete.

In case of the discontinuance or abandonment of the work, the architect's

charge shall be based upon an *estimated* total cost, which estimated total cost may be determined by the architect, by experts, or by the lowest bids of responsible contractors. *Total cost* is to be interpreted as the cost of all materials and labor necessary to complete the work, plus contractors' profits and expenses, as such cost would be if all materials were new and all labor fully paid, at market prices current when the work was ordered.



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2. On residential work, on alterations to existing buildings, on monuments, furniture, decorative and cabinet work, and landscape architecture, it is proper to make a higher charge than above indicated.

3. The architect is entitled to compensation for articles purchased under his direction, even though not designed by him.

4. If an operation is conducted under separate contracts, rather than under a general contract, it is proper to charge a special fee in addition to the charges mentioned elsewhere in this schedule.

5. Where the architect is not otherwise retained, consultation fees for professional advice are to be paid in proportion to the importance of the questions involved and services rendered.

6. Where heating, ventilating, mechanical, structural, electrical and sanitary problems are of such a nature as to require the services of a specialist, the owner is to pay for such services in addition to the architect's regular commission. Chemical and mechanical tests and surveys, when required, are to be paid for by the owner.

7. Necessary traveling expenses are to be paid by the owner.

8. If, after a definite scheme has been approved, changes in drawings, specifications or other documents are required by the owner; or if the architect be put to extra labor or expense by the delinquency or insolvency of a contractor, the architect shall be paid for such additional services and expense.

9. The architect's entire fee is itemized and proportionate payments on account are due the architect, as the following items are completed:

Preliminary Studies	2
General drawings	3
Specifications	1
Scale and full size details.....	1
General Supervision of the work...	3

Total1.00

Fee for complete services as agreed, or see paragraphs 1 and 12.

10. Items of service are comprehended as follows:

(a) **Preliminary Studies** consist of the necessary conferences, inspections, studies and sketches modified and remodified to determine the client's problem and illustrate a satisfactory general solution of same, both as to plan and elevation. Illustrative sketches for this purpose need not be to accurate scale, but should be approximately correct as to general dimensions and proportion.

(b) **General Drawings** include figured scale plans of the various stories, eleva-

tions of all the fronts, such general vertical sections as may be necessary to elucidate the design, and such details, drawn to still larger scale as, with the assistance of printed notes, and of the accompanying specifications, may make the whole scheme clearly evident to the mind of the competent builder and give him a full and complete comprehension of all the structure conditions as they affect the vital questions of quality and quantity of materials, of character of workmanship, and of cost.

(c) **Specifications** consist of a supplementary statement in words, of at least all those items of information regarding a proposed building which are not set forth in the drawings.

(d) **Detail Drawings** include all the necessary supplementary drawings required for the use of the builders, to enable them to so provide and shape their material that it may be adjusted to its proper place or function in the building with the least delay, and the smallest chance for errors and misfits. If not prepared until after the contract for the building is let they must not impose on the contractor any labor or material which is not called for by the spirit and intent of the "General Drawings" and "Specifications."

(e) The **Supervision** of an architect (as distinguished from the continuous personal superintendence which may be secured by the employment of a clerk-of-the-works or inspector of construction) means such inspection by the architect or his deputy, of work in studios and shops or a building or other work in process of erection, completion or alteration, as he finds necessary to ascertain whether it is being executed in general conformity with his drawings and specifications or directions. He has authority to reject any part of the work which does not so conform and to order its removal and reconstruction. He has authority to act in emergencies that may arise in the course of construction, to order necessary changes, and to define the intent and meaning of the drawings and specifications. On operations where a clerk-of-the-works or inspector of construction is required, the architect shall employ such assistance at the owner's expense.

11. Drawings and specifications, as instruments of service, are the property of the architect.

12. Exceptions.

Dwellings costing less than \$10,000..	10%
Lofts not requiring special planning for machinery or arrangement...	5%
Additions and alterations to dwellings.	12%
Additions and alterations to business buildings	10%

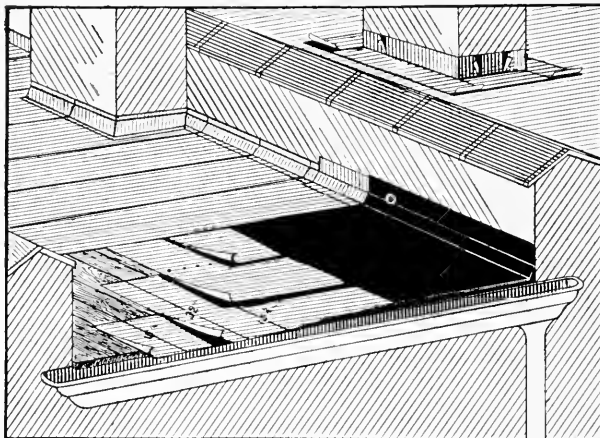
N. B.—Above schedule is considered minimum for ordinary and usual professional service. It is not considered fair or reasonable for highly specialized service.

VULCANITE BUILT-UP ASPHALT ROOF

ROOFING— Shall be VULCANITE Roofing, weighing 50 lbs. per square, single thickness.
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FOURTH— Coat entire surface uniformly with Vulcanite Asphalt to weigh 25 lbs. per square.
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Members of the Profession who will be Permitted to Practice in the State of Illinois.

Every means has been used to get a correct List of Licensed Architects who will be permitted to practice Architecture in the State of Illinois for the ensuing year. The names have been compared with the records of the State Board of Examiners of Architects and agrees with the Official Records of the State of Illinois.

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 Aga, Ole W., 139 N. Clark St.
 Ahlschlager, Walter W., 111 W. Washington St.
 Allen, James Roy, 751 Independence Blvd.
 Allison, Lyman J., 109 N. Dearborn St.
 Almquist, Carl M., 35 S. Dearborn St.
 Alschuler, Alfred S., 28 E. Jackson Blvd.
 Anderson, Helge A., 2857 Shakespeare Ave.
 Anderson, Pierce, 80 E. Jackson Blvd.
 Anderson, Russell A. M., 6128 Eberhart Ave.
 Andresen, Theodore, 643 Barry Ave.
 Anis, Albert, 155 N. Clark St.
 Anson, Carl T., 179 W. Washington St.
 Armstrong, John A., 11 S. La Salle St.
 Aroner, Jacob S., 139 N. Clark St.
 Ashby, Geo. William, 178 W. Jackson Blvd.
 Ashby, Wilbert B., 178 W. Jackson Blvd.
 Awsumb, George, 189 W. Madison St.
 Ayars, Charles R., 184 W. Washington St.
 Bailey, Cyrus, 1710 28 E. Jackson Blvd.
 Baker, Cecil F., 30 N. Michigan Ave.
 Baker, Frank S., 133 W. Washington St.
 Bannister, George S., 115 S. Dearborn St.
 Barfield, William G., 58 W. Washington St.
 Bargman, Ewald F., 815 Addison Ave.
 Barnes, Allen L., 1035-37 W. Van Buren St.
 Barnes, Julian, 332 S. La Salle St.
 Barrett, Fred L., 700-900 S. Michigan Ave.
 Barthel, Bernard, 127 N. Dearborn St.
 Barton, F. M., 178 W. Jackson Blvd.
 Bean, Ralph H., 104 S. Michigan Ave.
 Beaudry, Ralph L., 7047 Princeton Ave.
 Beaumont, George, 25 N. Dearborn St.
 Beck, H. Frederic, 8 S. Dearborn St.
 Beck, Willis J., 1221 Leland Ave.
 Beers, Herbert P., 38 S. Dearborn St.
 Behel, Vernon W., 25 N. Dearborn St.
 Beller, Henry P., 3166 Lincoln Ave.
 Bell, T. N., 3437 Ogden Ave.
 Beman, Spencer S., 332 S. Michigan Ave.
 Bendus, Wm. Quincy, 10 S. La Salle St.
 Bennett, A. J. T., 38 S. Dearborn St.

Bennett, Edward H., 1800-80 E. Jackson Blvd.
 Bennett, Wm. Arthur, 19 S. La Salle St.
 Benson, Edward, 118 N. La Salle St.
 Berlin, Robert C., 19 S. La Salle St.
 Bernham, Felix M., 2423 W. 63rd St.
 Bernhard, Willhelm, 64 W. Randolph St.
 Berry, Parker N., 6226 Wayne Ave.
 Bessler, Edward W., 1837 W. 12th St.
 Biallas, Theodore P., 8432 S. Sangamon St.
 Bicknell, Alfred H., 1443 Foster Ave.
 Bischof, Jacob H., 6333 Ingleside Ave.
 Bishop, Thomas R., 35 S. Dearborn St.
 Bjork, D. T., 1278 Clybourn Ave.
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 Borst, George Henry, 69 W. Washington
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 Bourke, Robt. E., 10440 S. Seeley Ave.
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 Bowes, Frederick Wm., 5123 Cullom Ave.
 Brabant, Frank J. E., 901 Wrightwood Ave.
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 Buck, Lawrence, 64 E. Van Buren St.
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 Carr, George Wallace, 122 S. Michigan Ave.
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 Chase, Frank D., 122 S. Michigan Ave.
 Chatten, Melville C., 64 E. Van Buren St.
 Cheney, Howard Lovewell, 30 N. Michigan Ave.
 Childs, Frank A., 122 S. Michigan Ave.
 Christensen, Chas. W., 127 N. Dearborn St.
 Christiansen, Eli, 7047 Indiana Ave.
 Christensen, Hans C., 7258 Union Ave.
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 Christie, Louis R., 139 N. Clark St.
 Chubb, John D., 109 N. Dearborn St.
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 Crowen, Samuel N., 30 N. La Salle St.
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 Davis, Zachary T., 64 E. Van Buren St.
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 Dowling, Edward F., 6 N. Michigan Ave.
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 Fugard, John Reed, 111 W. Monroe St.
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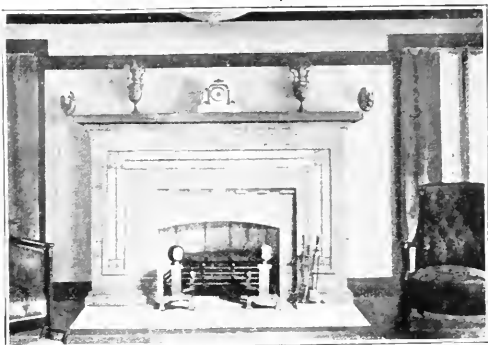
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 Hansen, Gunnard A., 5913 Peoria St.
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 Herr, Thornton A., 72 W. Adams St.
 Hetherington, John T., 69 W. Washington
 Hettinger, John P., 3171 N. Halsted St.
 Heun, Arthur, 64 E. Van Buren St.
 Higgins, Francis J., 327 S. La Salle St.
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Circular of Advice by Illinois Society of Architects Adopted April 28, 1914.

Believing that uniform practice in various architects' offices is desirable for all concerned, this Society recommends that the following conditions prevail in architects' offices of the State of Illinois:

Classification of Employees.

First. That employees be classed as Regular and Special;

Second. Employees classified as "Regular" will be those continually engaged for a period of not less than one year, on a weekly salary basis; it is expected that such employees will assume greater responsibilities to their employers and be granted special privileges, in consideration of faithful service;

Third. Employees classified as "Special" will be those engaged temporarily. It is deemed proper that such employees be paid by the hour for actual service rendered, making no allowance for vacations or holidays, it being considered fair under these circumstances to allow these draughtsmen a slightly higher rate per hour than regular employees who enjoy privileges of vacations and holidays.

Office Hours.

First. It is understood that draughtsmen are expected to be in their respective offices ready to begin actual work at the hours stated, and that they will continue in service at least until the hours fixed for cessation of work;

Second. The regular opening time of offices shall be 8:30 A. M., throughout the year;

Third. Period of service for Monday, Tuesday, Wednesday, Thursday and Friday, in the morning, shall be four hours, extending to 12:30 P. M.; that the lunch hour shall be one hour, extending from 12:30 to 1:30 P. M.; that the afternoon period shall be four hours, extending from 1:30 to 5:30 P. M.;

Fourth. That the Saturday period of service shall consist of 4½ hours, extending from 8:30 A. M. continuously to 1:00 P. M.

Units of Service.

First. One week's service will consist of 14½ hours;

Second. One year's service will consist of 2,180½ hours.

Pay-Day.

First. That pay-day shall be on Monday of every week;

Second. That each pay-day draughtsmen be paid up to the Saturday night preceding.

Holidays and Vacations.

First. We recommend that "Regular" draughtsmen be given the following holidays on full pay: New Year's, Decoration Day, July Fourth, Labor Day, Thanksgiving, Christmas;

Second. That all "Regular" draughtsmen having been in the employ of an architect for more than one year be given two weeks' vacation on full pay, at time most convenient for employer;

Third. It should be understood that "Regular" draughtsmen, quitting the employer's service of their own volition, preceding the completion of any year's service, shall not be entitled to vacation allowance;

Fourth. "Regular" employees terminating service at the request of their employer shall be entitled to an allowance in cash proportionate to two weeks' salary allowed for vacation in the same ratio as period of service bears to one year;

Fifth. Vacations and holidays are understood to be granted to employees for rest and recuperation, the employee being understood to be in the service of the employer during vacation and holiday time just to the same extent as when regularly engaged in the office;

Sixth. It is recognized that an average of 44½ hours per week's service is the maximum efficient service that can be continuously rendered without detriment to the health or efficiency of the employee, and that where the employee engages in outside architectural service of any sort for others, he does so at the expense of his employer, and his employer should be credited for corresponding loss of time. The practice of employees of one employer working nights or holidays for another is condemned as detrimental to the best interests of both employer and employee;

Seventh. In case of emergencies of short duration, "Regular" employees are expected to work over-time for the employer without extra remuneration other than a reasonable allowance for the expense of taking meals away from regular lodging place. In such cases, however, the employees will be credited with off time on account of sickness or otherwise, equivalent to the amount of over-time service rendered in cases of emergency;

Eighth. Draughtsmen are encouraged, however, to make use of a portion of their time off for educational improvement.

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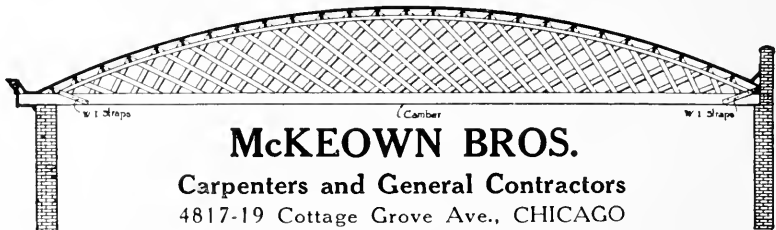
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Prosecuting Attorney, 6th floor, north end.

Public Works:

Commissioner, 4th floor, center.

Bureau of Engineering, 4th floor, north
end.

Bridge Division, 4th floor, north end.

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end.

Bureau of Sewers, 4th floor, south end.

Bureau of Streets, 4th floor, south end.

Bureau of Water, 1st floor, north end.

Water Pipe Extension Division, 4th floor,
north end.

Sanitary Inspection, Bureau of, 7th floor,
north end.

Sewers, Bureau of, 4th floor, south end.

Smoke Inspection, Department of, 6th floor,
south end.

Special Assessments (Board of Local Im-
provements), 2nd floor, south end.

Special Assessments (Law Department), 2nd
floor, south end.

Special Park Commission:

Secretary, 10th floor, north end.

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Stationary Engineers, Board of Examiners
of, 10th floor, south end.

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Steam Boilers and Steam Plants, Department
of Inspection of, 1st floor, Washington
St. entrance.

Streets, Bureau of, 4th floor, south end.

Supplies, Department of (Business Agent),
vault floor, north end.

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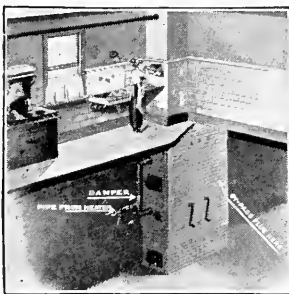
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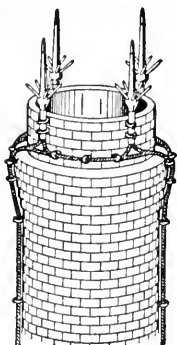
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SPECIFICATIONS FOR INTERIOR MARBLE WORK.

Scope of Contract: The Interior Marble Contractor shall include all labor and material necessary to furnish and install complete the Interior Marble Work for **STRATFORD BANK AND OFFICE BUILDING, CHICAGO, ILLINOIS.**

All as called for in specifications under head of Interior Marble Work and shown on Architect's drawings Nos. 1 to 64 inclusive, and detail sheets Nos. D101 to D108 inclusive.

Samples.—Average samples not less than 12" x 24" x 7/8" with one face finished shall be submitted in triplicate to the Architect for approval. One each of the approved samples to be returned to Interior Marble Contractor, to be used as a guide in selecting and manufacturing the marble.

Selection of Marbles.—All marble shall be the standard of the kinds and grades hereinafter specified; selected so as to avoid sharp contrasts of color of background or veining.

Banking Room.—The floor of the Banking Room Public Space shall have a 16" wide border of Alabama Pocahontas marble with a field of Alabama Grade A marble floor Tiles 16" x 16" square. The walls of the Banking Room Public Space shall have a marble wainscot to a height of 8'-0" above finished floor line of Alabama Pocahontas marble, consisting of Base, Die and Moulded Cap, as shown on detail. Die to be of Ashler approximately 14" x 30".

The Bank Counter facing Public Space shall have a Base, Die, Ledge, Deal Plates, Pilasters and Cap Mouldings of Alabama Pocahontas marble. The Deal Plates at Tellers' windows shall be countersunk to receive glass inlay furnished by Glass Contractor. The Check Desk shall be of Alabama Pocahontas marble cut to receive glass top furnished by Glass Contractor.

Safe Deposit.—The Safe Deposit Public Space shall have Alabama Grade A Floor Tiles 16" x 16" with a 16" border of Pocahontas Marble.

The walls of Public Space in Safe Deposit Department shall have marble wainscot consisting of 10" x 7/8" Base, Ashler Die and Moulded Cap Alabama Pocahontas Marble.

Main Entrance Vestibule and Elevator Lobby of First Floor.—The Main Entrance Vestibule and Elevator Lobby of First floor shall have marble floors consisting of a 16" wide border of Alabama Pocahontas marble, with a field of 16" x 16" Tiles of Alabama Grade A marble. The walls of Entrance Vestibule and walls of First floor Elevator Lobby and trim of Elevator fronts on First floor shall be of Alabama Pocahontas marble. The walls to have approximately 14" x 30" Ashler, with 10" x 7/8" Base and Moulded Cap, as per detail.

Marble Seats.—The marble seats in Banking Room, Safe Deposit Department, and First Floor Public Lobby shall be of Alabama Grade A marble.

Main Stairs.—Main stairs, basement to 20th floor shall have marble Treads of Alabama Grade A marble. Main Stairs from Elevator Lobby to Second floor shall have an Ornamental Balustrade, Hand Rail, Newel Post and Risers of Alabama Grade A marble. Main Stairs from basement to first floor and second to twentieth floor shall have marble wainscot 4'-0" high, without Base or Cap, except at landings, which shall have 10" x 7/8" Base, all of Alabama Grade A marble.

Upper Corridors.—The Public Corridors and Elevator Lobbies on Second to Twentieth floors shall have a marble wainscot 7'-2" high, consisting of 10" high Base and 6'-4" Die in one piece extending up under wood Cap, as shown on detail, with 10" x 20" marble floors without border, all of Alabama Grade A marble.

Drinking Fountains.—Upper corridors shall have 8" x 16" marble drinking Fountains where indicated on drawings, of Marble to match adjoining Marble work.

Janitor Closets.—Janitor closets shall have 8" x 16" marble floors with 2" x 2" Cove Base and 6'-0" high wainscot.

Toilet Rooms.—All Toilet Rooms shall have 8" x 16" Marble floors, with 2" x 2" Cove base without border, and Marble wainscot 6'-0" high with 4" x 1 1/4" Cap.

The water closet stalls shall have Marble backs 7'-6" high in one piece, partitions 6'-0" high raised one foot above floor, and stiles 2" thick x 7'-2" high, with Marble rail 4" x 2" over Stiles, and Cove Shoe under Stiles and Backs. Urinals to have Backs 7'-10" high with partitions 6'-0" high x 1'-6" wide. Countersunk floor slabs 2" thick, all of Alabama Grade A marble.

Barbershop.—The Barbershop shall have marble wainscot 7'-0" high consisting of 4" x 1 1/4" Cap, 6'-7" x 7/8" Die, 2" x 2" Cove Base with 12" x 12" x 7/8" Tile floors, all of Alabama Grade A marble.

Boot Black Stand.—The Boot Black stand in Barbershop shall consist of Step and Platform 1 1/4" thick, with 7/8" thick polished Ends, Risers and Back, all of Alabama Grade A marble, drilled for foot rests furnished by Hardware Contractor.

Shower Room.—The Shower Room adjoining Barbershop shall have 7/8" thick and 8'-0" high marble wainscot, partitions and backs, with 1 1/4" thick Stiles, Rail and Curbs, with 2" thick countersunk marble floors in shower stalls, and 8" x 16" x 7/8" marble Tiles for remainder of floor.

Door Plinths.—All Door openings where marble is used for walls shall have marble Plinths to match marble Base.

Thresholds.—All door openings leading to or from marble floors shall have marble Thresholds to match marble floors.

Thickness of Marble.—All Floor Tiles, Border, Risers, Wainscot Die, Toilet and Urinal Backs and Partitions shall be 7/8" in.

All Base shall be 7/8" thick, except at exposed ends, which shall be 1 1/4" thick.

All stair Treads shall be 1 1/4" thick, except Treads of Main stairs First to Second floor, which shall be 1 3/4" thick.

Finish of Surfaces.—All exposed surfaces of marble shall be highly polished except floors, Thresholds, Cove Base and Stair Treads, which shall have fine rubbed finish on exposed surfaces.

Joints.—All joints shall be rubbed and not in excess of 1-16th inch unless otherwise specified. All bed joints shall be the full thickness of the marble. All vertical joints in wainscot panel shall be "V" joints havingarris slightly removed as shown on detail.

Cutting and Fitting.—The Interior Marble Contractor shall do all cutting and fitting of Marble necessary for the installation of Plumbing Work. Toilet hardware and Toilet Doors.

Setting.—All standing Marble shall be set with Moulding Plaster and Copper or Brass dowels and anchors.

All floor Marble shall be set in Portland Cement and when dry shall be grouted with Atlas White Cement.

Marble for Toilets, Urinals, Showers, etc., shall be set by a system of grooves, anchors, dowels, etc., of concealed fastenings without the use of exposed metal work.

Concrete foundation under Marble floors will be brought up within two inches of finished floor level by another contractor. The interior Marble Contractor shall take the work at this point furnishing the necessary cement mortar bedding to complete the work. This contractor shall clean his Marble work at completion, leaving it in perfect condition.

Hardware.—All hardware for Toilet Rooms, Shower Rooms, Barbershop, etc., will be furnished by Hardware Contractor.

R. V. REYNOLDS, General Sales Manager Alabama Marble Company, Ry.Ex., Chicago

INDEX TO BUILDING ORDINANCE

(See pages 96 to 197)

	Section No.		Section No.
A		Area —Floor maximum (Class VII).....	481-482
Access to rooms, otherwise than through bed rooms (Class 6).....	469	Of floor for each standpipe.....	269
Air —Volume per person (Class II. b)..<	262	Of habitable room	274
See also Ventilation (Class 6).....	447	Of lot occupied by residence.....	271
Aisles —Grandstands and bleachers, re- quirements	359	Of stage vent (Class IV. b).....	320a
Cross (Class IV. c).....	336	Of stage vent (Class IV. c).....	347a
Assembly halls, recitation and study rooms (schools), requirements.....	501	Of window	274
Least width—"main" aisles—obstruc- tions (Class VII).....	487	Floor—in tenements: Restrictions as to alterations, etc., for living pur- poses	476
Passageways and hallways; require- ments (Class IV. a, b and c).....	311	Vent shafts	443
Class V	384-5, 407, 409-10	Tenement house, percentage of lot al- lowed to be covered	440, 476
Incline of (Class IV. c).....	333	Ashlar Facing —Requirements.....	535
Required each side of seats.....	313	Assembly Hall —(Class IV. b).....	240j & 300
Steps in (Class IV. c).....	336	In schools, requirements.....	496 and 501
Alcoves —Must comply with Section 446 (Class 3)	275	Asylum Buildings	240f, 254c, 263
And alcove rooms (Class 3 & 6. Tene- ment house, definition and construc- tion	446	Athletic Amphitheatre	240-1
Alteration of buildings—General require- ments	512 to 514	Attic —(Class 6). Living purposes—re- strictions as to alterations for.....	476
Remodeling—requirements	717 3/4	Auditorium —Floor height (Class IV. c)	331a
In tenement house—permit for.....	434	Frontage (Class IV. a).....	288
Alter any theatre unlawful.....	282	Frontage (Class IV. c).....	289
Unlawful (Class IV. d).....	368	Automatic Sprinklers:	
Amusement Parks —Elevator Inspector in charge examine and approve plans, etc	220c	Class V.	417
Included under (Class IV. d).....	356	Tanks	571
Provisions governing	362-368	Tanks (Class V.)	393
Amusement—places of: Annual inspec- tion	237	(See fire apparatus.)	
Certificate required prior to issue of license	721	Auxiliary Buildings —As part or whole of Class IV. b; construction require- ments	302
Diagram of seats on programs.....	726	Axes, Standpipes, Pumps, etc. —See Fire Apparatus.	
Doors or gates not to be locked— when	725		
Frontage consents—when necessary..	715	B.	
Lighting requirements	722-723-724	Bakeries —Ventilation, location.....	256d
Apartment house	240n	Balcony —Construction to be either steel or wrought iron	673
Definition	432b	Balconies and Galleries —What consti- tute, etc., in Class IV. b.....	309-310
Boiler chimneys	576	Class IV. c, requirements.....	335
Divided by masonry (Class 6).....	455	Class V., requirements.....	383, 408
Apparatus for fighting fire	674	In hospitals	268
Appeal from Decision	206	Balcony —Over street	230c
Approval of Plans	212	Banquet Hall	240j
Arbitration —Provisions governing in questions of damage to or security of buildings	206-7-8	Included under Class IV. b.....	280, 300
Arches in fireproof construction	638	On any floor in fireproof buildings; limit, 900 persons	306
Architect must		Barns —See Stables and Barns.....	616
Certify as to floor loads.....	251	Under 500 square feet	270
Certify as to compliance with law.....	238, 618	Base Ball Bleachers —(Class IV. d).....	356
Seal and sign plans.....	231	Baseball Park:	
Draw plans to scale.....	231	Included under Class IV. d.....	356
Not alter stamped plans.....	232	Seats	240-1
Not allow departure from stamped plans	239	Basement —(Class VI.) In re wall con- struction	457
		"English" style—requirements.....	432, 454
		Schools—when used for class-rooms— when allowed	506b
		Tenement houses (when raised); re- quirements	658

	Section No.		Section No.
Basement and Cellar —Definition.....	432, 599	Contractors not to commence work without permit	239d
Sub-basement and cellar; construction requirements—pipes and openings, dumb-waiter, cable, etc., passing through, enclosure required.....	600	Construction or alteration of existing—provisions governing	513-14
Bath Room —(Class II.) building.....	256c	Damage by fire (Class VI.)	472½
Bath Rooms —In dwellings.....	276 & 274	Damage or question of security; provisions governing arbitration in re	206-7-8
Bath Rooms, etc. —(Class III.) requirements	276	Department established; appointment of Commissioner; bond required; his duties and authority as to assistants	199-200-200½
Bay Windows—Light Courts—Shafts: Construction	603	Existing, used for Class IV. b, etc. Requirements as to fire walls and doors	302, 303
Bay Windows and Light Shafts —(Class III.), when allowed	277	Existing, used as Class V. built in conjunction with other classes; requirements as to doors.....	376
Beams —See Fireproof Construction, Reinforced Concrete, Timber and Girders.	548, 632	Fire Department tear down or remove at direction of Commissioner.....	204
Billboards, Sign-boards, Signs and Fences —Everything pertaining to.....	695-710	Buildings, Frame —Basement or story placed beneath; floor level—walls—height limit	653
Blacksmith Shop —Frontage consents—when necessary	712	Changing into flat buildings—separating wall requirement	655
Block (City Block) —See Frontage Consents	711	Chimney requirements—metal smoke pipes or flues through floors and partitions	659
Board of Education —Fire escapes on schools; President of Board report as to, three times yearly.....	509	Erection within fire limits prohibited—exception; erection outside limits—requirements	654
Boarding, Sales or Livery Stables —Forbidden on residence streets.....	616, 712	Ice houses—construction, etc.	663
Boilers, Inspector of —Plans of buildings—duty to inspect, when.....	230	Lot line requirements.....	660
Boilers (Steam) —Ceiling, protection of—asbestos, cements, etc., covering	588	Moving within and without fire limits—frontage consents	714
Floor protection around	587	Moving picture shows not allowed in after June (July) 1st.....	285, 332, 400
Location—permit	589	(Sec. 400 only, amended June 26, 1911.)	
Bond of Brick Work	537	Raising requirements; changing gable or hip roofs to flat roofs—two-story and attic, prohibited conversion to three-story	656
Around (Class V.)	375	Repairing within fire limits—50% provision—masonry wall requirement..	653
Bonds —Billboard and signboard erection	706	Sheds—open shelter, etc.....	661-662
Commissioner of Buildings and subordinates	200, 226	Uniform height, when carried to—requirement as to habitable rooms...	657
Illuminated roof signs—to be executed prior to erection of.....	710d	Tenements—requirements	451
Street obstructions	615a	Tenements, additions to within fire limits prohibited	452
Indemnifying	233	Width on lots—fire walls required when—where more than one on a lot, distance between	660
Wreckers of buildings	235b	Height and construction when used wholly or in part for Class IV. purposes	286
Box Office—Communication with (Class V.).....	428	Also see Height.	
Brick:		Inspection of all in general use required, and power of Commissioner as to safety precautions and repair.	201
Brickwork—bond of—pressed brick facing	537	Permits—relating to.....	229-230-234, 235, 236, 360, 434
How laid	538	(See also Permits and Fees for Permits.)	
Soft—where permitted	536	Police to assist Commissioner in enforcement of law pertaining to....	209
"Spite" walls so-called.....	709	Unsafe; refusal of owner to comply with notice to repair; consequences	202e
Wall (brick) not required in Class I..	245	Unsafe; authority of Commissioner in dealing with	202-205, 208
Building Department —Officers of, designating	199, 200	Water used, in construction; regulations and fees	233
Buildings —Amusement parks; concerning erection in	364, 365	Wrecking, permits, etc.	235-236
Annual inspection	237	Height of	598
Architect's certificate as to compliance with plans	238	Roof constructions as to bearing loads	516c
Construction contrary to plans prohibited	239	Skeleton construction—definition of term and provisions governing.....	569
Brick, stone or concrete (existing); removal unlawful unless, etc.....	515	Structural detail; tests, how made....	517
Built in conjunction with (Class V.), to be fireproof	403	Bunting —Exhibition and exposition halls; when allowed	304
(Class I.), less than 90 and more than 50 feet in height, must be of slow-burning, mill or fireproof construction	244b		
(Class I.) of ordinary construction limited to four stories.....	244c		
Constructed in violation of law; authority to tear down or stop...203, 205			

	Section No.		Section No.
Capacity of Rooms —Places of amusement and theatres—certification for license	322-349-399-423	Right of entry (Class V.)	370
Capacity —Seating, how computed (Class IV.)	298	Roof signs —illuminated; and other duties in relation to	710bc
Camp-stools, Sofas, etc. —Not allowed in aisles, etc., of theatres	311	Theatres, halls, etc., duties relative to and in connection with	321-322b-324-348-351-396-425-428-722-725
Canopy —Construction requirements and permit	601	City Officers —Power of entry	228-283-370
Over street	230c	Power to close	284-371-511
Ceiling —Protection from boilers, etc.	588	Class —Where buildings are used for more than one—requirements pertaining thereto	241
Structures over (Class IV. b)	318	Classes —Definitions of—(Class I.)	243
Structures over (Class IV. c)	344	Class II. (and its subdivisions)	254
Structures over (Class V.)	415	Class III.	270
Tenement houses where stores occupy first story:		Class IV. (and its subdivisions)	280
(See Tenement House.)		Class V.	369
Ceiling and Roof —Space between (Class I.), concerning	248	Class VI.	430
Cellars and Basements —Definition	599	Class VII.	478
(See also Basement.)		Class VIII.	492
Cellars in Dwellings	274	Class IX. (Police stations, etc.)	511 a to k
Cement —Plaster covers, skeleton steel walls requirements in	245	Classification of Buildings —From I. to VIII.	240
Tests, requirements	556	Closing Buildings for Cause —(Class IV.)	284
Certificate —Architect—as to floor load.	251	Class V.	371
As to plans complying with law	238, 618	Schools	511
Elevator (lift) inspection—to be posted	689	Clubhouse —(With sleeping accommodations for less than 20 persons) included in Class II. a; more than 20, Class II. b.	254
Of capacity of rooms in Class IV. b, c and V., prerequisite to issuance of license	322, 349, 399, 423	General classification	257
Signature of Commissioner necessary; record to be kept of department	210	Coaster Devices —Roller	362
Character or kind of every building	212	Coffee Roasters —Floor protection	587
Chimney —Concrete (reinforced)—air space	574	Cold Storage Houses —Fire precautions	675-6-7
External; not to encroach on street or alley—location—anchoring—iron base	582	Collective Dwelling	240n
Flue-lining requirements	574, 575-578, 579, 580, 582, 584-659	Columns —Formulae for wood	539
Frame building—construction requirements	659	Formulae for metal	541b
Height above roof (dwellings)	577	Formulae for metal and concrete	541d
Insulating lining	575	Formulae for reinforced concrete	552
Insulating cavities—where required	578	In fireproof construction; requirements	624-5-6
Insulating material	580	Theatre walls—alterations	375
Interior—framing around—joists and girders not to rest on	581	Thickness, construction and height	519
Isolated—design and construction	583	Commissioner of Buildings and Subordinates —Appointment, bonds, etc.	199-200-200½ and 213 to 226
Isolated—permit for—fee	234c	Commissioner of Buildings —Power to pass on all provisions of building ordinance	201d
Metal, and metal stacks; insulating material	580	Appeal from his decision	206
Metal or reinforced concrete in fireproof buildings—air space; construction, etc.	574-575	Arbitration	206-7-8
Metal, in ordinary, slow-burning or mill construction	579	Commissioner of Health —Hospital location—duty in re frontage consents.	265
Tenement and apartment house boiler.	576	(See also note end of ordinance page 190.)	
Walls forming smoke flues—material.	584	Power to close buildings of Class V.	371
Chimneys and Flues —Tenement house requirements	460	Right of entry (Class IV.)	284
Church Building or Place of Worship —(Class IV. a)	280, 287b	Right of entry (Class V.)	370
Classification	240	Tenement house (new)—certificate from—necessary before occupation ..	435
General requirements	238-299	Commissioner Public Works —	
Inspection	237	Must pass on permits, when	230c
Livery stable, not allowed nearer than 200 feet	616	Storage space in street or alley—may limit or restrict	610
Cinder Concrete —Provisions governing use	568	Street obstruction (storage), permit from, necessary, etc.	515
(See also Concrete and Reinforced Concrete.)		Complaint —	
City Electrician —Power to close building of Class IV. for violations	284	Investigation	212
Same as to Class V.	371	Of citizens, action on	201b
Right of entry (Class IV.)	284	Record of	212
		Concrete —Cement tests	556
		Chimneys (reinforced)—air space	574
		Cinder concrete, provisions governing use	568

	Section No.
Foundation piles; tests, how made.....	531
Framework requirements in Class I..	245
Sand, stone and mixing.....	557, 558, 559
See also Reinforced Concrete.....	545 to 566
Conflict —Between general and special provisions—special to govern.....	242
(See also Sec. 433, as to question of conflict.)	
Construction —Buildings used for more than one class—provisions governing	241
Capacity to determine (Classes IV. a, IV. b and IV. c).....	290-304-332
Fireproof defined	619
Mill defined	649
Ordinary defined	652
Slow burning defined	646
Construction or Alteration —General provisions	512-544
Contractors required to register with Commissioner of Buildings (see ordinance on page 192).	
Control of Lighting —(Class IV. a).....	299
Corner Lot Defined	437
Cornices, etc.: projection beyond lot lines	230c
Cornices, Eaves, Gutters, Pipes from Roofs —Metal required except, etc.; bracket requirements	591
Corridors, Passageways, etc., and Doors —Width—computation (Class IV.)	295
Same as to Class IV. b.....	312
Same as to Class IV. c.....	337
Same as to Class V.	385-410
Same as to Class Schools.....	499
Corridors in Dwellings	274
Courts: (Class II.); requirements	256ae
Definition of	432
Department stores; requirements.....	484
Inner and outer required for tenement house (as defined in 432); minimum widths and areas	442
Light courts—construction	603
Tenement houses; requirements as to	442-463-456-458-476
Courts and Light-shafts —Requirements. (See also Shafts and Vent shafts.)	602
Court Walls —Window and door requirements	602
Coves —Hospital requirements	266
Cross-Aisles —(Class IV. c).....	336
Cubic Contents Habitable Room —(Class II. & VI.)	274
Cubic Feet of Air per Person —(Class II. b)	262
Cupolas of Foundries —Height above roof	590
Curtains —School assembly halls; restrictions	505
Theatres to have incombustible; other requirements; inspection and fee.....	317, 342, 389, 412
D.	
Damage to Building or Question of Security —Arbitration, relating to.....	206 to 208
Damp Proofing —Tenement house (new)—basement requirements	457
Dance Hall —Included under Class IV. b	240(j), 280(c) 300
Dangerous Buildings —Notice to owner—sign or notice on structure, etc.....	202, 205, 208

	Section No.
Department of Buildings Established —Commissioner, his appointment, bond, duties and appointment of subordinates	199-200-200½
Department Stores —Classification.....	240 b & o
Aisles: Stair aisles	486
Aisles: General provisions	487
Basements—sale of goods in; limitation as to sub-basements	480
Construction—when may be slow-burning, mill or fireproof	479
Court requirements; windows, doors, etc., to have metal frames.....	484
Doors: Dividing walls—how built.....	490
Exit—percentum of width	486
Street level—revolving doors.....	489
Exit signs and lights.....	486, 488
Fire drill	(See ordinance passed July 18, 1910.)
Floor areas—maximum	481
Floor areas exceeding maximum.....	482
Galleries, mezzanine or intermediate floors; area, height, stairways and general construction	483
Halls, stairs, passageways, aisles, signs and lights	486
Lights in stairways and halls—independent lights—red lights	486
Loads—allowance for live	491
(See also 516.)	
Locker provisions	480
Passageways, stairs, halls, aisles, signs and lights	486
Signs (exit) and lights	486, 488
Stairs, halls, passageways, aisles, signs and lights	486
Stories—what constitute, and how numbered	485
Twelve lower stories (above street grade) may be used for sale of goods or manufacturing	480
Derricks —Use and limitations.....	612
Detection Houses	240f, 254c and 263
Domes —(See Towers, Domes and Spires.)	
Doors —Amusement, places of—not to be locked, when	406-726
Between Class V. buildings and buildings of other classes; restrictions as to	276
Connecting (Class V.)	276
Class IV. a, requirements.....	295, 297
Dividing walls—openings prescribed.	490
Dividing walls—iron door requirements	573
Emergency exits to open outward...	297
General provisions as to.....	572-573
In fireproof construction—requirements	630
Iron and tin clad doors, provisions as to	572-573
Lifts (elevators), requirements.....	685-686
Locked or fastened (Class IV. b).....	315b
Not locked or fastened (Class IV. c).	340
Openings in Class I.....	246
Openings (Classes I, II, IV, V, VII, and VIII), nature of protection; iron; wired glass in metal frames..	572
Outward opening provision, and draping prohibited in places of amusement	246, 277, 315, 340, 385, 386, 500
Revolving, in Class I.....	246
Revolving, department stores.....	489
Rolling, sliding and swinging iron, steel or tin-clad; requirements.....	573d, e, h, i, k

	Section No.
Schools—to open outward	500
Space in front of (Class V.).....	380
Swinging iron and tin-clad; require- ments	573d, h
Swing doors—when required	572
Theatres (Class V.): Entrance—basis for computation of widths	386
Theatres (Class V.); vestibule for stage doors to prevent draughts..	391
Theatre procenium openings (other than curtain); requirements.....	317, 343
Theatre entrance, width prescribed..	386
Width—computation (Class IV. b)....	312
Down spouts—requirements.....	591
Width of (Class IV. c)	340
Draperies and Bunting —Exhibition and exposition halls; when allowed, etc..	304
(Class IV. b), restrictions	315
(Class IV. c), restrictions	340
Fireproofing (schools)	505
Dressing Rooms in Theatres —(See Theatres.)	
Dwellings —Definition and general re- quirements	430-477½
Dwelling	270

E.

Eaves, Cornices, Gutters and Pipes	591
Electrical Conduits —(See Gas Pipes.)	
Electrical Requirements: (Class IV. b.)	
Fuse box covering	321
Light requirements	323, 324
(Class IV. c.)	
Fuse box covering	348
Light requirements	350, 351
(Class V.)	
Fuse box covering	392d
Light requirements....395, 396, 424, 425 (See also Lights.)	
Cut-out boxes, chases, etc., in fire- proof buildings, requirements	637
Electrical Equipment Maintained —(Class IV. b)	321
Electrical Equipment Maintained —(Class IV. c)	348
Elevation of Main Floor —(Class IV. a)	291b
Elevators (Grain) —Bulk grain, fireproof structures required (Class I.).....	253
(See Class I., for classification.)	
Fire apparatus and watch service..	675, 676, 677

Elevators (Lifts):

Enclosures (Class II. b).....	261b
Hospitals—provisions governing.....	267
Inspection of	220, 221
Permit and fee therefor—general re- quirements	681-690

Emergency Exits—Provisions govern- ing.

(Class IV. a)	297
(Class IV. b).....	311, 314, 323
(Class IV. c)	339, 350
(Class V.)	388, 395, 411
Places of amusement	722
Schools	502
(See also Exits.)	

Employees—Not to engage in other busi- ness

Enclosures on Roofs—Requirements....	594
Engineering Staff —Duties	214, 215, 216
"English" Basement	432, 454

	Section No.
Entry —Power of	228, 283, 370
Entrances Separate from Exits —(Class IV. b)	310
Entry, Power of Public Officers —Pun- ishment for	283
Erase, Alter or Modify Plans not Law- ful	232
Exhibition Hall	240j
Existing Buildings —(Class I.), built prior to this ordinance, height in- crease requirements	247
Tenements—provisions of this chapter not to apply, when	473
Existing Theatres	374
Existing theatres may not increase seat- ing capacity —(Class IV.).....	327
Existing Walls —(Class V.)	374
Exits —Provisions governing:	
Amusement, places of..722, 723, 725, 726 (Class IV.)	292, 293, 297, 299, 314, 323, 339, 350, 359 (Class V.)
..379, 384, 388, 395, 405, 406, 409, 411 Schools	502, 503
(See also Emergency Exits.)	
Exit Signs —Places of amusement, halls and churches; requirements cover- ing day and night...299, 323, 395, 420	
Exits—Locking or Fastening of pro- hibited	297b
Exposition and Exhibition Halls —(As- sembly halls.) (Class IV. b)....	240, 284, 300
Exposition Hall	287c
Exposure —Street or alley (Classes IV. a, b, c and V.)..228, 289, 301, 331, 402	
Extensions of Existing Buildings	247

F.

Family Residences and Garages and Stables —Less than 500 square feet area) included in Class III.....	270
Fastening Exits Prohibited —(Class IV. a)	297b
Fastening Exits Prohibited —(Class IV. c)	340
Fees for Permits and Inspection —Ac- counts of to be kept; report to coun- cil of receipts	211
Alterations and repair of buildings..	234b
Billboard or signboard—erection and inspection	234c, 706a
Buildings other than sheds, erection of	234a
Buildings, inspection of	237h
Repair or alteration	234b
Buildings (under requirements of Sec. 237)	234c
Curtains in theatres—iron, steel or as- bestos, inspection of..234c, 317, 342, 389	
Elevator (lift), installation or altera- tion	234c
Iron door or wire work, enclosures around	681c
Elevator (lift), inspection (semi-an- nual)	234c
Fire escape erection	234c, 670b
Fire escape inspection	670b
Illuminated roof sign, inspection and approval	234c, 710c
Fees—Method of Estimating	234
Oil tank construction, etc.	693a
Raising (other than frame) buildings. 234b	
Roller coasters, scenic railways, etc., erection of	367
Roof, re-coating and re-covering....	234a

	Section No.
Sheds	234a
Signs—illuminated and other on roofs —erection and inspection	234c, 710c
Stairway fire escape	670b, 1
Street obstructions during building operations	615
Tanks for oil; construction	693
Tanks on roofs, permit fee	234, 571
Theatres, etc., fees for inspection...	237
Fees:	
Water	233
Wrecking building	234c, 235c
Fences —Regulations as to height.....	709
Fire Apparatus —Fire Marshal to con- trol	329, 352, 366, 394
397-8, 417, 418, 421, 426, 674-729-734-735 (See also Grain Elevators and Theatres.)	
Fire Doors —Auxiliary buildings to thea- tres and halls; requirements (Class IV. b) (c).....	302, 303
(See also Secs. 519 and 573.)	
Fire Drills:	
Department stores. (See Ordinance of July 18, 1910.)	
Schools, how maintained, etc.	510
Fire Escapes —Changes in position or construction prohibited unless, etc.	679
(Class II. c) must be equipped with.	268
(IV. b) stairway fire escapes.....	314
(See also Secs. 669-70 and 673.)	
Inspection of	222, 223, 670
Ladder type—when permitted	671
Specifications	672
Lights indicating (Class VII.).....	488
Obstructions to prohibited	679
Oiling or greasing cables.....	670j
Painting	670k
Pulleys, etc.—ice and snow protection..	670j
Regulations as to construction, num- ber and location, in general.....	669, 670, 671
Requirements as to buildings of—or- dinary construction	669d
Mill or slow-burning construction.....	669e
Fireproof construction	669f
Fire Escape Stairway Location	314b
Buildings of Class III.....	279
Schools—provisions governing	508-9
Signs indicating location	678
Stairway escapes: Permit fee—loca- tion—erection—specifications	670
Tenement houses	466
Fire Limits —Defined	718
Fire Marshal —Amusement parks: Fire apparatus under supervision of.....	366
Amusement—places of, duty in re	721, 722, 723, 726
Elevator hatch doors (lifts): exam- ination, etc.	686
Grain elevators—jurisdiction as to fire apparatus and precautions	675-676
Hospitals, homes for aged, jails, asyl- ums, houses of detention, duties in relation to	269
Oils, storage, etc.: Duties in connec- tion with	692, 693
Power to close (Class IV.).....	284
Power to close (Class V.).....	3
Right of entry (Class IV.).....	283
Right of entry (Class V.).....	370
Schools: Duties in connection with..	509-510-511
Standpipes and fire-fighting apparatus —approval of plans	230b, 674
Temporary seating structures, to tear down or remove, when.....	360
Theatres—duties in relation to.....	320, 322, 326, 327, 329, 346, 347b, 352, 353a, 388, 390a, c, 342c, 393, 394c, 396, 397, 398, 413a, c, 416c, 417b-418-421-425-426
Fire Precautions —Steamer Siamese connections—regulations and require- ments	677

	Section No.
Fireproof Construction , definition, mate- rial.....	619, 620, 621, 622
Fire Stop Between Joists —(Class II. b)	261c
Fireproof Construction —(Class IV. a)...	290b, 299
Fireproof Construction —(Class IV. b)...	304
Definition and general regulations, materials, etc.	619-645
Reinforced concrete requirements....	564
Fireproof Material —Definition.....	620
Fire Retarding Solution —Draperies, bunting, etc., to be treated (Class IV. b)	304
Grandstands and bleachers to be treated with	358
Scenery to be treated..	326-7, 353, 390, 413
Schools, curtains, etc.	505
Fire Walls —(Class I.) in re.....	249
Frame buildings—when required.....	660
(See also Walls.)	
"Five-cent" Theatres —(See Moving Pic- ture shows.)	
Flats —Alterations of buildings into....	655
Floors —At exits, to be level, etc.....	380, 406
Floor Area of Habitable Room	274
(Class I.), strength, and display of placards	251
Department stores, maximum:	
Areas, not to exceed, etc.	481
Areas, exceeding maximum.....	482
Fireproof construction	639
Fireproof construction, use of wood and nailing strips	640
Levels: Limitations in Class IV. a.	291
Limitations in Class IV. b.....	306
Limitations in Class IV. c.....	333
Limitations in Class V.....	377, 404, 406
Loads permitted. (See Loads.)	
Main, designation in Class V....	383, 408
Protection of, in connection with steam boilers, furnaces, ovens and coffee-roasters	587
Temporary, during building construc- tion	605
Flues —Class IV. a, material composing.	299
Class IV. b	320
Class IV. c	347
Class V.	416
Class VI.	443
Football Parks —Class IV. d.....	356, 357, 358, 360
Foundations:	
Allowable stresses and special re- quirements	525
Buildings 40 or more feet high—re- quirements	527
City's underground construction, must not rest upon, when, etc.	527
Component parts—construction	528
Depth below surface—must rest on hard soil	527
In wet soil—trench requirements....	526
New and old walls—construction—load limit—protection from frost.....	529
Pile borings requirements.....	530
Piling of concrete—tests, how made..	531
Piling: protection against splitting— grillage—size of piles—loads (for- mula)	530
Steel rails or beams in concrete—im- bedment	532
Where not permitted.....	527
Foundry:	
Cupolas—height required	590
Frontage consents—where necessary..	712
Foyer not Open to Auditorium V	382b
Frame Buildings —See Buildings.	
Frontage Consents:	
Amusement parks	363

	Section No.		Section No.
Frontage Consents—Cont'd.		Slow burning construction.....	647
Amusement, places of—when neces- sary. (See also Sec. 117.).....	715	Not to rest on enclosed chimneys.....	581
Billboards and signboards.....	707	Plate; flanges and compression (for- mula)	544
"Block," definition of word.....	711	Girder Protection Over Ceiling:	
Building operations adjacent to prop- erty being built upon.....	613	Class IV. b.....	318
Fire limits—provisional, consents for erection of buildings.....	719	Class IV. c.....	344
Garages—when consents are necessary	716	Glass Area Requirements—Class III. and VI.	274
Gas reservoir, packing house, rendering plant, soap factory, tannery, black- smith shop, foundry, smelter, metal refinery, machine shop, factory com- bined with a foundry, laundry run by machinery, livery stable, board- ing stable, sale stable, medical dis- pensary, second-hand store or yard, smoke-house	712	Grain Elevators:	
Grandstands and bleachers.....	358	Fire precautions	675, 676, 677
Hospitals or sanitariums.....	265	Fireproof construction, when.....	253
(See also note end of ordinance page 190.)		Grain in bulk, fireproof structure re- quired	253
Lumber yards, when required.....	664	Grandstand	280e
Meat selling	717½	Grandstands, included under Class IV. d.	240 1, 356
Moving frame buildings.....	714	Grandstands and Bleachers:	
Open shelter—under what circum- stances required	662	Construction requirements	358, 359
Reformatories and like institutions— when necessary	713	Load, allowance for live.....	357
Sheds—coal, brick, stone, cement.....	602	Grandstands—Class IV. c.	358b
Sheds—open shelter, when required....	662	Gutters, Cornices, Eaves, Pipes from Roof	591
Stables and barns.....	616		
Stores—retail—when necessary.....	712a	H.	
Temporary seating structures (outdoor exhibitions, holiday and special oc- casions): requirements	360	Habitable Rooms:	
Theaters of Class IV. c.....	355	Class III., what constitutes.....	274
Frontage Requirements—Class IV. b....	301	Frame buildings, changing from one to two story—requirement	657
Frontages on Street or Alley Required for Auditoriums:		Habitable Rooms—all classes.....	274
Class IV. a.....	288, 289	Halls:	
Class IV. b.....	301	Assembly exposition, exhibition, ban- quet, dance, lodge and parish, and those for instruction (other than schools) included under Class IV. b.	280, 300
Class IV. c.....	331	Public or club, used occasionally for theatrical purposes, not classed as public theaters	369
Class V.	402	Halls (passageways):	
Furnaces—Floor protection around.....	587	Class IV. a requirements.....	295
Furnace (hot air):		Class IV. b requirements.....	312
Theaters, Class V., prohibited in.....	419	Class IV. requirements.....	385
Fuse boxes—See Electrical requirements.		Class V. requirements.....	410
		Class VI. requirements.....	453, 454, 474
G.		Class VII. requirements.....	486
Galleries—		Class VIII. requirements.....	499
Class IV. a (exit and entrance).....	293	Handrails:	
Class V., designations.....	383, 408	Stairways, when required on.....	379, 495
Rise limitation V.	382a	For wide stairs, Class IV. b.....	308
Garage—Frontage consents—when neces- sary	716	In tenement houses.....	162b
(This section was re-enacted July 17, 1911.)		On each side stairs, Class IV. b.....	308
Included in Class III. (where less than 500 sq. ft. area).....	240, 270	Single, double and intermediate.....	668j
Gas Pipes and Electrical Conduits:		Heights (other than of buildings):	
Restrictions as to enclosing, in col- umns or fireproofing; also the rest- ing of on beams or girders.....	629	Billboards and signboards — height above ground or grade of street.....	697
Gas Reservoir:		Chimneys above roof.....	577
Five hundred foot limit from public school	617½	Cupola of Foundry	590
Frontage consents—when necessary....	712	Fence	709
General Merchandise Store. Sec.....	240e	Illuminated signs on buildings—pro- visions governing	710ab
General Provisions Governing Building Operations	512 to 544	Height of Buildings:	
General and Special Provisions—conflict —special to govern.....	242	Class I.	241
(See also Section 433.)		Class II. a.....	258
Girders:		Class II. b.....	260
Fireproof construction, covering....	631, 632	Class II. c.....	264

	Section No.		Section No.
Fireproof and non-fireproof (general provisions)	598	Lecture Hall Not in School.....	287c
Roof-rise above limit	644	Ledges:	
Frame, changed from one to two story	657	Joist supports	520
Height Limit Ordinary Constructed Hospitals	264	License:	
Height Limit, Class IV.	286	Amusement (places of).....	721
Height Limit Ordinary Constructed Residences	271	Theaters—capacity certificate as to rooms a prerequisite to issuance....	322, 399, 423
Height of Wood Sills Supporting Brick Homes for Aged and Infirm, or Children,	240, 254, 263	Theaters, revocation	372
Hospital:		Light Shafts and Bay Windows:	
Buildings	240f, 254c, 263	Class III, when allowed.....	277
Coves in rooms or corridors; requirements	266	Lights:	
Elevators in, when required.....	267	Aisles, passageways, etc., to be provided with in theaters, etc.....	299, 311
Frontage consents necessary.....	265	Calcium forbidden, where.....	724
(See also note end of ordinance page 190.) (See also Sec. 1108 of Code as amended.)		Electric and gas light protection.....	324, 351, 425
Included in Class II. c.....	240, 254, 263	Placing and control of otherwise.....	323, 324, 350, 351 395, 396, 420, 424, 425, 721, 722, 723
Hot Air Furnace—		Schools, requirements	504
See Furnace.		Lighting of Class—IV. a.....	299
Hotels, included in Class II. b.....	240e, 254	Lintels:	
House Moving—Brick, etc., 515; frame..	714	See Girders.	
Houses of correction, included in Class II. c	254, 263	Livery, Boarding and Sales Stable:	
		Frontage consents—when necessary...	712
		See also	616
		Loads:	
I.		Class I., square foot calculations.....	252
Ice Houses—		Class III., allowance of live.....	273
Within and outside fire limits—construction requirements	663	Class IV., allowance for live, and width of stairways.....	292
Illuminated and Other Roof Signs:		Class IV. b, allowance for live, and construction	307
Definition—construction requirements fees—bond	710	Class V. (theaters), allowance for live loads and construction.....	378
Incline of Aisles—Class IV. c.....	333	Class VII, allowance for live.....	491
Inflammable Material:		"Dead" load defined, and wind resistance	516
Storage or keeping loose prohibited—exception as to residences when in bales	717	Dead and live applied to all classes (with tables)	518
Insane Asylums, included in Class II. c.	240, 254, 263	Department stores, allowance for live.	491
Insanitary Conditions or Nuisance.....	477½	See also 516.	
Inspection of All Buildings Annually.....	201, 237	Foundation walls, limit prescribed....	525, 529, 530
Inspection:		Floor construction design, Class I., for live loads	252
Curtains in theaters.....	317, 342, 389	Same, Class II.	255
Inspection Fees:		Grandstands and bleachers, allowance for	357
See Fees for permits and inspection.		Live, allowance per square foot of floor areas; exception as to schools.....	516
Inspectors:		Live and dead; wind resistance.....	516
Of buildings	217, 218, 219	Metals, requirements including stresses produced by wind forces.....	541, 542
Of elevators (lifts)	220, 221	Roof construction to bear, when.....	516c
Of fire escapes	222, 223	Stairways, load minimum.....	516f
Iron (cast) Columns:		Locate Hospital, frontage consent.....	265
Use prohibited, when, etc.....	541h	(See also note, end of ordinance, page 190.)	
J.		Locking Doors from Interior Prohibited.	246
Jails, included in Class II. c....	240, 254, 263	Locking Exits Prohibited—Class IV. a..	297b
Joists:		Locking Exits Prohibited—IV. c.....	340
Supports required in Classes I., II., IV., V., VII. and VIII.....	520	Lodge Hall—included under Class IV. b.	240f, 280, 300
Joists and Girders:		Lodge Hall	287c
Not to rest in enclosed chimneys.....	581	Lodging Houses—included in Class II. c.	240(e), 254, 262
L.		Lot—plat of to be furnished to Building Department prior to building operations (tenements)	436
Ladder Fire Escapes:		Lot Line:	
When permitted—specifications....	671, 672	Frame building requirements.....	660
Lath:		Must be shown, etc.....	231
Metal, in Class I., requirements.....	245		
Wood (and plastering) relating to (originally Sec. 722)....	605		
Laundry, Run by Machinery:			
Frontage consents—when necessary...	712		
Laundries in Dwellings.....	276 and 274		

	Section No.		Section No.
Lot Line Courts:		Nuisance:	
Inner and outer defined.....	442	Buildings constructed in violation of this chapter or unsanitary to consti- tute a.....	719
Lumber Yards—		See also 477½.	
Location—frontage consents, when re- quired	664		
Storage near residences, etc., prohibi- ted except, etc.....	665	O.	
M.		Obstructions in Aisles, Passageways, etc.	311, 336, 384, 411g
Machine Shop or Factory, Combined with Foundry:		Office Buildings —included in Class II. a.	240d, 254, 257
Frontage consents—when necessary..	712	Oils —storage of	691 to 694
Main Floor:		Old People's Homes	240f, 263 to 265
Class V., designation.....	383, 408	Operation of Ventilating System Re- quired ...	256f
Maintenance of Stairs: Class IV. a.....	297a	Ordinary Construction:	
Malt Houses:		Definition	652
Fire precautions.....	675, 676, 677	Class IV. a.....	290, 299a
Manufacturing Buildings —included in Class I.	243	Ovens:	
Marquise Construction — requirements and permit	601	Floor protection around.....	537
Masonry:		P.	
Ashlar facing	535	Packing House—	
Brick, allowable compression.....	533b	Frontage consents—when necessary...	712
Definitions	534	Pantry—	
Foundations of to be laid in cement mortar	528	Class II. building	256(c)
Piers (isolated) of concrete, brick or masonry—height (formula).....	533fg	Class III., requirements.....	276
Stresses allowable and special require- ments (table), (rubble, granite, sandstone, concrete and brick)....	533	Parish Hall —Included in Class IV. b...	240j, 280, 300
Mechanical Ventilation —requirements... 256 (See also Secs. 432 and 442.)		Pantries in Dwellings	276 and 274
Merchandise Buildings (sale, storage or manufacturing), included in Class I.	240b, 243	Parish Hall	300
Metals:		Parish Hall	287c
Allowable stresses (maximum) and spe- cial requirements	541, 542	Partition:	
Plate girders, flanges, compression (formula)	544	In fireproof buildings.....	641, 642
Loads—live and dead—stresses...541, 542		In mill construction building.....	650
Riveting, concerning	543	In slow-burning buildings.....	647
Mill Construction:		Material, Class II. b.....	262
Definition, materials, etc.....	649, 650, 651	Smoke-pipes passing through; require- ments	586, 659
Moving:		Theater dressing rooms, pertaining to.	328, 354, 387, 422
Brick, stone or concrete—requirements as to construction at old and new lo- cation	515	Partitioning of Rooms Prohibited With- out Permit	274
Frame buildings—permit for—consents —affidavits—space occupied (gov- erned by Sec. 440).....	714	Party Wall:	
Moving Picture Shows —classification...240k		Provisions governing	522
Moving Show	280d	(See also 521.)	
Moving Picture Shows:		Passageway Location and Direction of in Class II. b.	262
Amusement parks; when located in, must comply with IV. c.....	364c	Passageway:	
Frame buildings—not allowed in after June 1 (July), 1911.....	285, 332, 400	See also Halls: passageways.	
(Sec. 400 only, amended June 26, 1911.)		Penalty:	
Compliance with provisions of Class IV. c).....	364c	Billboard or signboard erection, failure to comply, etc.	708
Moving Picture and Vaudeville Theaters:		Illuminated signs, erected without au- thority	710f
Definitions and requirements, Class IV. c.	330-355	Violations of building law.....	720
Picture machine booth; construction..	345	Permit:	
Theatres above first floor declared a nuisance. See ordinances following building ordinances.		Billboard and signboard	701
Mullions:		Buildings—erection, enlargement, al- teration, repair or renewal, necessity of obtaining	229, 230
Fireproofed, when	633	Elevator (lift) (passenger and freight) construction	681
N.		Fees for—(See Fees for Permits, etc.)	
Notices by the Commissioner of Unsafe Buildings	202b	Encroachments—does not authorize...230c	
Notice to Commissioner of Health Re- quired	256f	Illuminated roof signs (by inference).710c	
		Moving frame building.....	714a
		Oil tank construction.....	693a
		Street obstruction (also bond condi- tions)	615
		Tanks on roofs	571
		Tenement, for change or alteration... 434	
		To be kept on job while, etc.....	230
		Voiding of	229
		Wrecking, requirements concerning, and revocation in certain cases...235, 236	
		Picture Machine Booth:	
		See Moving Picture and Vaudeville.	

	Section No.
Picture Shows, Moving	240k
Piers:	
Concrete, brick or masonry (isolated), height, etc. (formula).....	533fg
Piers (General provisions):	
Loads on, live and dead with tables..	518
Pipes:	
Gas or electric pipes or conduits, re- strictions as to enclosing in columns or fireproofing; also as to resting on beams or girders	629
Tenement house, plumbing require- ments	472
Plans:	
Examination and approval; record of inspections and complaints.....	212
Stamping and recording of plans....	230
To be kept on job while, etc.....	230
Essentials of	231
Alterations—concerning	232
Architect's certificate	238, 618
Construction contrary to plans unlaw- ful	239
Plastering and Wood Lathing—Require- ments (originally numbered 722)....	605
Plat of Lot —To furnish department buildings with prior to building op- erations (tenements)	436
Plate Girders:	
See Girders.	
Plumbing:	
Requirements in certain cases.....	470, 471, 472
Police:	
Assistance to be given commissioner, when, etc.	209
Stations, classification.....	240, 254, 263
Superintendent of, power given to close school buildings, when, etc....	511
Police Stations, included in Class IX.	511 a to k
Porches:	
Parapet walls on—requirements.....	524
Tenement house requirements.....	459
Porches, Verandas and Porticos:	
Construction inside fire limits.....	570
Portable Frame Buildings (Schools)....	495
Post Foundations	278
Power of Entry:	
Class IV. buildings	283
Class V. buildings	370
In general	228
Projecting Masonry Between Joists:	
Class II. b.	261c
Protection of Skylights:	
Class III.	272
Public Highway:	
No permit for its use until, etc.....	230c
Pumps:	
See Fire Apparatus.	
B.	
Record:	
Of complaints	212
Of inspections	212
Of location and character of buildings.	212
Of notices	210b
Red Lights	614
Reformatories and Like Institutions:	
Frontage consents—when necessary...	713
Remodeling of Buildings—requirements.	71734
Removal (moving) of Buildings.	
See Moving.	

	Section No.
Reinforced Concrete:	
Beams (I beams); limiting width of flange	550
Beams or rails—embedment in con- crete	532
Definition of term.....	545
Cement finish	563
Cement tests—how conducted.....	556
Cinder concrete construction.....	568
Columns—limit of length—reinforce- ment—bending moment—tying ver- tical rods	552
Columns—structural steel—require- ments	552
(See also table, 546.)	
External forces—moments of (with formulas)	549
Fireproof construction	564
Flanges in beams—width limit.....	550
Forms, removal of.....	565
Freezing and warm weather—placing.	561, 562
Ratio of moduli of elasticity—adhe- sion—bond (with table).....	546
Sand-stone—mixing—placing concrete.	557, 558, 559, 560
Shrinkage and thermal stresses	551
Slabs, beams and girders—designs for	548
Steel used in—bending and elongation of	555
Stresses (unit of) for steel and con- crete	547
Terra-cotta hollow tile—term defined— stresses not to be exceeded—spe- cial provisions in connection with using—columns—walls	567
Tests; how conducted	566
Walls (curtain) in skeleton construc- tion—requirements	554
Reinforced Concrete:	
See also Concrete.	
Rendering Plant:	
Frontage consents—when necessary..	712
Repairs or Alterations —powers of the commissioner to require.....	201 b and c
Residences, Family —included in Class III	240, 270
Riveting:	
Holes, diameter, etc.....	543
Roller Coasters:	
Amusement parks, what permitted, plans, fee, etc.....	362, 367
Rise of Banks of Seats —Class IV. a....	296
(See also seats.)	
Roofs:	
Construction and pitch.....	595
Enclosures upon; construction require- ments	594, 598
Gable or hip changing to flat (frame buildings)	656
Load maximum	516e
Rise above limit of height in fireproof construction	644
Shingle or gravel.....	595, 596
Sidewalk—roof over during building operations	609
Spectatorial purposes, use for prohib- ited	361
Water from—how carried to ground..	591
Rooming Houses —included in Class II. c.	240e, 254b
Rooms:	
Access to, otherwise than thru bed- rooms	469

	Section No.		Section No.
Assembly halls in schools—requirements	496	Sections Conflicting —to be governed by Class VI. (in respect to tenements)	433
Basement class-rooms	506	See also Special and General provisions when in conflict	242
Bath, pantry, water-closet and urinal—requirements	276	Separation of Auditorium and Stage:	
Cubic contents of rooms	262	Class IV. b.	316, 317
Habitable—Class III., what constitutes	274	Class IV. c.	340, 342 and 343
Hospitals—tangent coves in	266	Sewerage and Drainage System Shown ..	231
Lodging houses—sleeping stalls	262	Shafts:	
Tenements—requirements	475	Construction (general provisions)	603
Rubble Stone —Ordinary definition	534	Definition of	432
RULINGS on mooted points by Commissioner of Buildings, page 194.		Drainage of—grade	468
		Enclosure (fireproof construction)	630
		Enclosure in hospitals	267
S.		Shavings and Sawdust:	
Safety:		Storage in residences prohibited	717
Power of Commissioner as to precautions	201	Sheds, Shelter —classification	240-1
Safety Devices:		Sheds:	
Scaffolding and temporary floors	604	Open shelter—allowable height—area, etc.; requirements when enclosed; restrictions in and outside fire-limits	661
Window cleaning	604	Open shelter adjacent to railroads or navigable waters—requirements and restrictions—frontage consents	662
Sanitariums:		Shingle Roofs.	
Frontage consents necessary	265	See Roofs.	
(See also note end of ordinance page 158.)		Show Cases:	
Included in Class II. c.	254	Exhibition and exposition halls; when allowed	304
Sawdust:		Shows and Outdoor Exhibitions, etc.:	
See Inflammable Material.		Temporary seat requirements	360
Scaffolds and temporary floors during building operations	605	Sidewalk or Street Occupation During Building Operations:	
Scenery:		Provisions governing	607 to 615
Class IV. b. definition and requirements	325, 326, 327	Sills:	
Class IV. c. requirements	353	Brick walls on, level, etc.	278
Class V., requirements	413, 427	Iron and tin-clad doors, between; requirements	573fj
Movable, defined	325, 427	Window and door; construction and material	597
Movable—in what buildings it may be used	369	Signboards and Signs.	695 to 708
School assembly halls, not permissible in except as to curtains or screens—fireproofing	505	And (illuminated)	710
"Set of house scenery," defined	327	Signs:	
Exception	353	Church and places of worship—exit signs	299
Used, requirements—IV. b.	319	Dangerous buildings, form of to be posted upon	202b
Scenic Railway, Water Chute or Other Mechanical Riding, etc., Device:		Exit, etc., in theatres—(See Theatres.)	
Provisions governing	367	Sinks:	
School:		Requirements (Class VI., tenements) ..	471
Assembly halls—curtains and moving-picture machines in	505, 505½	Skating Rinks —included under Class IV. b.	240, 280, 300
Building, Classification	240p	Not allowed above first floor	306c
Close for violations of this ordinance, Power to	511	Skeleton Construction:	
Definition, and provisions governing erection and compliance with the building ordinance (including "portable buildings")	492 to 511	Definition of term and provisions governing	569
Gas reservoir or tannery, not allowed within 500 and 600 feet of, respectively or livery stable within 100 feet	616, 617, 617½	Skylights (as ventilators).	256c
Class IV. a. computation for each person, where seats are not fixed	298	Skylights:	
Seats:		Class III., requirements	272
Class IV. a. number allowable ..	296, 298	Construction—glass in	593
Class IV. b.	313	Sleeping Room	274
Class IV. c.	338	Slow-Burning Construction:	
Class IV. d.	360	Definition, materials, etc.	646, 647, 648
Class V.	351	Class IV. a.	290, 299
In places of amusement	726	Class IV. b.	304
Movable, computation of space, etc., Class IV. b.	305	Smoke Flues:	
Rise of banks	296	Walls forming part of—requirements ..	584
Seats, Boxes and Show Cases:		Smoke-pipes:	
Exhibition and exposition halls; when allowed	304	Passing through partitions; requirements	586
		Smoke, Inspector of:	
		Plans, when to be inspected by	230b
		Soap Factory:	
		Frontage consents—when necessary ..	712

	Section No.		Section No.
Solid Masonry:		Standpipes and Hand Pumps—Class II.	
Definition	432	c, requirements	269
Space of Seats:		Standpipes and Hose—Theatres, stage	
Class IV. a.	296	required to have	319, 327, 346, 394, 418
Class IV. b.	313	Stands—Grand	2401
Class IV. c.	338	Starting of Work—Time limit.....	229
Space Above Partitions	262	Steamer Siamese Connections—Require-	
Space Between Aisles—(Class IV. a.)..	296	ments	677
Special and General Provisions—Special		Steel Frame Construction—(See Skele-	
to govern when conflicting	242	ton Construction.)	
(See also Section 433.)		Steel Rails or Beams in Foundation	
Spectatorial Purposes—Reefs used for		Work—Concrete embedment.....	532
prohibited	361	Steps—"Winders" not permitted in thea-	
Spire—(See Towers, Domes and Spires.)		tres of Class V., except, etc....	379c, 405
"Spite" Walls or Fences.....	709	Steps in Aisles—Class IV. a, require-	
Sprinklers—Automatic—Grain Elevator,		ments	294
malt house, etc.	675	Class IV. b	311
Theatre, where placed	327, 393, 417	Class IV. c.....	336
Stables—(Area of 500 square feet or		Class V.	384a, 409c
over) included in Class I.....	243	(See also Stairs and Stairways.)	
Included in Class III. (where less than		Rise and tread of V.....	378c
500 square feet area).....	240b, g, 270	Stone in concrete—requirements....	558
Stables and Barns—Construction—floor		Stone—ordinary rubble, defined	534
requirements—location, when for-		Storage Buildings—Included in Class	
bidden	616	I.	240b, 243
See also as to frontage consents..	712	Storage—	
Stables, or Stabling Horses—(See or-		Building materials on street—regula-	
dinance passed governing location as		tions	610
to schools, churches, etc.)		Oils	691 to 694
Stage—(See Theatres.)		Shavings and sawdust in residences	
Stairs and Stairways—Banquet halls,		prohibited, except, etc.	717
provisions for (b).....	306	Store Fronts—Columns and lintels sup-	
Changes in position or construction		porting; construction	597
prohibited without proper permit... 679		Stores—Classification	240b
Class III, requirements	279	Retail: Frontage consents—when nec-	
Class IV, requirements	292, 294, 297, 299	essary	712a
Class IV. b requirements	303	(See also Class VII.)	
Class IV. c requirements	334	Story—Class VII., numbering of.....	485
Class V, requirements	379, 388, 405, 410, 411	Class VIII., numbering of.....	507
Class VI, requirements	444, 454, 462, 463, 464, 465	Definition of story	432
Department stores above 12th story,		Street Encroachments	230c
or leading to sub-basement, require-		Street—(See also Sidewalk or Street.)	
ments	480a, c, d	Street Obstructions—	
Other provisions	486	Materials on Street; Regulations... 610	
Emergency (Class IV. a).....	297a	Excavated material on, etc.....	611
Enclosures (Class II. b).....	261b	Frontage consents of adjacent own-	
Load minimum on.....	516f	ers	613
Fireproof construction—requirements.. 643		Use of street and termination there-	
Location, construction, number and		of—red light	614
width, in general	666, 667, 668	Obstructions—permit—fee	615
Obstructions in or to prohibited... 467, 679		Stresses—Foundation requirements....	525
Schools, width, etc.	497, 498	Live and dead loads	542
Slow-burning construction—require-		Masonry	533
ments	648	Metals—allowable and special require-	
Spiral, where permitted.....	668	ments for	541
Stair hall, defined	432	Steel and concrete—unit for	547
Sub-basements and cellars—number		Thermal and shrinkage	551
and width	480c, d, 600	Timber	539
Tenement houses—see Class VI above.		Structural Details—Strength tests....	517
Theatres, etc.: Duty of Commissioner		Structures—Other than those specifically	
to inspect annually and compel in-		provided for in this ordinance; de-	
stallation where lacking.....	237	sign and construction	592a
Special requirements (Class IV. a)...		Structures over Ceiling—Class IV. b... 218	
.....	291b, 292 & 294	Class IV. c.....	344
Winders prohibited	497-668	Sub-Basements—(See Basements and	
Stairway Fire Escapes—Permit neces-		Cellars.)	
sary—erection—location—specifi-		Sub-Cellars—(See Basements and Cel-	
cations	670	lars.)	
In buildings of Class III.....	279	Superintendent of Police—(See Police.)	
Stalls, in Sleeping Rooms—Provisions		Superintendent of Streets—	
governing	262	Occupation of streets by builders—	
Standpipes, etc.—Amusement parks must		duty in re	610, 613, 615
have	366	Plans, when his duty to inspect....	230
Grain elevators, malt and cold storage			
houses	675		
Standpipes and Fire Fighting Appa-			
ratus—Other than on theatre build-			
ings—requirements—exceptions	674		

	Section No.
Switches for Vent —Operation (Class IV. b)	320c
T.	
Tanks —Oils, storage of.....	693, 694
Roofs—construction requirements....	571
Theatres, as to	393, 417
Tannery —Frontage consents—when nec- essary	712
Six hundred foot limit from church, public or private school	617
Temporary Seating Structures —Require- ments and restrictions.....	360
Tenement House —Air in rooms, require- ments	447, 448
Alcoves and alcove rooms; definition and construction	446
Alley or yard in rear; percentum of space, etc.	441
Alterations or changes in construction of existing buildings	473-4-5-6-7
Apartments, solid masonry dividing wall between required; exceptions. (See also 519)	455
Area—percentage allowed to be cov- ered	440
Basement requirements for habitable rooms in new	449
Basement walls to be damp-proofed; floor of cement	457
Basements or cellars (existing build- ings); living room restrictions....	477
Bay window, court and vent shaft re- quirements	458
Bulkhead (or scuttle) in roof; con- struction	461
Ceilings over stores (buildings 3 stories or less); construction re- quirements; courts or shafts above first story	456
Cellars, habitable rooms in, prohibited in new	449
Classification	240m
Conflict with other provisions—Class VI. to govern	433
Corner lot, defined	437
Courts—inner and outer (as defined in 432); minimum widths and areas... 442	
Courts or shafts above first story, how supported	456b
Damage by fire, requirements as to rebuilding or repair	472½
Definition of terms used in construc- tion of	432
Distance between buildings, restric- tions	439
Drainage of shafts, courts and yards. Existing buildings; provisions of this article (IX.) not to apply to, except, etc.	473
Existing buildings; provisions as to changes or alterations.....	474-7
Fire escapes, when required and to be unobstructed	466-7
Fireproof and slow-burning construc- tion requirements	450
Flue and chimney requirements....	460
Frame, outside fire limits; dividing wall (apartment) and around stairs; requirements	451
Frame within fire limits, additions to prohibited; moving restrictions....	451
Halls, entrance widths and ceiling re- quirements	453
Halls, stair, in non-fireproof buildings less than 3 story, construction... 454	
Height—how measured	438
Inspection—when builder or owner is entitled to	435c, d
Living rooms in cellars or basements of existing buildings, when per- mitted	477
New—when to be occupied	425
Nuisance, what constitutes.....	477½

	Section No.
Permit for building or changing re- quired	434
Plat in re erection, alteration, mov- ing, etc., to be filed	436
Plumbing requirements	471-2
Porch requirements	459
Roof bulkhead construction	461
Rooms, access to not through any bed- room	469
Rooms, sizes, etc., attic rooms....	445
Stair hall and shaft—well hole di- mensions	444
Stairways, width and construction....	462-465, 467
Terra cotta, reinforced hollow tile: Definition of term and provisions governing use	567
Vent shafts, areas of.....	443
Walls (dividing) in apartment houses; requirements and exceptions	455
Water closet requirements; windows or artificial light (see also 443)....	470
Window requirements in habitable rooms, bath, etc., and pantry....	448
Terra Cotta , when and where to be used.	567
In fireproof construction.....	619-622
Tests:	
Cement	566
Elevators (lifts)	639
Fireproof construction, for.....	621
Reinforced concrete construction....	566
Theatre:	
Admission fee, when charged and where movable scenery is used (Class V.)	240m
Included under Class V.....	369-429
(But see also Classes IV. b and c.)	
Automatic sprinklers, where placed...	393, 417
Box office, stage and fly-galleries; communication (telephone) between.	428
Capacity limit (Class IV. b, IV. c and V.)	322, 349, 399, 423
Changing from Class IV. to V., latter to govern	429
Class V. hereafter erected; wall con- struction to be fireproof	401
Construction over ceiling; require- ments (if occupied by people)...	313, 344
Curtains to be incombustible; inspec- tion and fee, etc.	317, 342, 389, 412
Doors, (Class V.); entrance—basis for computation of width	386
Doors in rear or sides of stage (Class V.); vestibule to prevent draughts...	391
Exit lights to be independent, etc....	324, 351, 396, 420
Doors to remain unlocked when, etc....	315b, 340, 388b, 410b
Dressing room partitions.....	328, 354, 387, 422
Existing, provisions governing.....	373, 400
Hereafter erected, provisions gov- erning	401-429
Buildings existing, time of passage...	300
Exit signs:	
Class IV. b.....	323
Class IV. c.....	350
Class V.	395, 420
Exits, provisions covering emer- gency and other.....	314, 323, 350, 359, 388, 395, 405, 406, 409, 411, 420
Fire apparatus, Fire Marshal to con- trol	328, 352, 397-8, 421, 426
Fire escapes—(See Fire Escapes—re- quirements, etc.)	
Floor levels—(See Floors.)	
Frame buildings, not allowed in after June 1, 1911	285, 400
(See also 332.)	
Note.—Sec. 400 only, was amended June 26, 1911, which see at end of these building laws.	
Frontage consents (Class IV. c).....	355
Furnace in, prohibited (Class V.)....	419
Fuse box requirements	321, 348
Handrails on stairways, requirements.	379
"House scenery, set of," defined....	327
Exception	353
Inspection annually	237
License, revocation of	372

	Section No.		Section No.
Walls —Isolated (including "spite fences")	709	Opening—(Class III. and VI.)	274
Walls, Piers and Columns —Dead and live		Cleanings, safety devices for workmen	604
load proportions (all classes with		Openings Class II. buildings	256b
tables)	518	Openings in Classes I., II., IV., V.,	
Water —Building construction, use, etc.	233	VII. and VIII.—metal frames—wired	
Water Closet Compartment —(Class II.)		glass	572
building	256c	Requirements—(Class III. and VI.)	274
(See also Bathroom, etc.)		Sills—incombustible	597
In dwellings	276 and 274	Tenements; requirements where chang-	
Water Pressure —(Class IV. b.)	319	ing from existing	475, 476
(Class IV. c.)	346	Ventilation—in relation to—(See Ven-	
Width of Aisles —(Class IV. c.)	336	tilation.)	
Widths of Corridors, Passageways, Hall-		Windows and Mechanical Ventilation —	
ways and Doors —(Class IV. b.)	312	Class II., requirements and exceptions.	256
Width of Corridors, Passageways and		(See also Ventilation.)	
Doors —(Class IV. c.)	336 and 339	Wood Lathing and Plastering —Require-	
Width of Door —(Class IV. b.)	314a	ments	605
Width of Emergency Exits —(Class IV. b.)	314a	Wreck or Destroy Unsafe Building —	
Wind Pressure —Resistance of struc-		Powers of Commissioner	203, 212d
tures, where height exceeds twice		Wrecking or Tearing Down Building —	
least dimensions	592a	Permit fee and permit and bond ..	234, 235
Resistance—general provisions	516	Revocation of permit	236
Window:			
Area rooming house	262		
Heights of Class III. and VI.	274		

Y.

Yard—Definition of	432
Tenement—must have, etc.	441

NOTE

In order to insure absolute accuracy and certainly correct legal designation, the editors of the Handbook have exercised every possible care in the presentation of the Building Ordinances, the copy being carefully checked over direct from the official minutes of the City Council, and presented exactly as passed. Architects will find that sections and paragraphs are correctly designated or numbered, which is not the case with some of the other publications of the Ordinance. The legal Ordinance is the one passed by the City Council, including all of their mistakes.

Several Ordinances pertaining to Buildings will be found at the end of the Building Ordinance on pages 161 to 171, inclusive. These Ordinances have to do with ERECTION AND LOCATION OF BUILDINGS, and have no special section numbers.

Special Rulings of the Building Department will be found on pages 168-171.

No expense has been spared to prepare what we believe to be a complete and comprehensive index of the Ordinance. Instead of following the old system of indexing each classification separately, we have provided one index to cover the entire Ordinance, which will doubtless prove more convenient than the former method.

BUILDING ORDINANCE

OF THE CITY OF CHICAGO

(Originally passed by the City Council December 5, 1910.)

Comprising Sections 199 to 727, inclusive, of The Chicago Code of 1911, with all amendments thereto up to and including July 10, 1916.

All amendments up to July 10, 1916, will be found printed in italics under proper Section numbers, except the Fire Limits Ordinance. (Section 718 and the new Article XIa.) A star ★ marks all amended Sections.

Attention is called to the several new ordinances following the building ordinance, having to do, or in connection with the erection or location of buildings.

AN ORDINANCE.

Relating to buildings within the City of Chicago.

Be it ordained by the City Council of the City of Chicago:

Section 1. That there is hereby added to the Revised Municipal Code of Chicago of 1905 a new Chapter to be known as Chapter XV, which shall read as follows:

CHAPTER XVI.

Buildings.

ARTICLE I.

***199. Department of Buildings Established—Officers.)** There is hereby established an executive department of the municipal government of the City of Chicago which shall be known as the Department of Buildings and which shall embrace a Commissioner of Buildings, a Deputy Commissioner of Buildings, an Engineer in charge, a Building Inspector in charge, an Elevator Inspector in charge, a Fire Escape Inspector in charge, a Secretary to the Commissioner of Buildings and such number of *Assistant Engineers in charge, Assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors, Fire Escape Inspectors and such other officers, assistants and employes as may be from time to time provided for in the annual appropriation ordinance.*

**Amended May 27, 1912.*

***200. Building Commissioner—Appointment—Bond—Other Officers—Offices Created.)** (a) There is hereby created the office of Commissioner of Buildings. He shall be the head of said department of buildings and shall be an experienced architect, or a civil, structural or architectural engineer or a building contractor or an efficient building mechanic and shall have been engaged as an architect or a civil, structural or architectural engineer or building contractor or building mechanic for a period of not less than ten years prior to his appointment; and during his term of office as Commissioner of Buildings he shall not be engaged in any other business.

(b) He shall be appointed by the Mayor, by and with the advice and consent of the City Council.

(c) The Commissioner of Buildings before entering upon the duties of his office shall execute a bond to the city in the sum of twenty-five thousand dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of his duties as the Commissioner of Buildings.

(d) *There are hereby created the offices of Deputy Commissioner of Buildings, Engineer in charge, Building Inspector in charge, Elevator Inspector in charge, Fire Escape Inspector in charge,*

Secretary to the Commissioner of Buildings, Assistant Engineer in charge and of such number of Assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors and Fire Escape Inspectors as may be from time to time provided for in the annual appropriation ordinance. The incumbents of these offices shall be known and designated by their respective titles as herein set forth.

**Paragraph (d) added May 27, 1912.*

***200½. Powers—Appointment of Subordinates—Duties of Commissioner.)** (a) He shall have the management and control of all matters and things pertaining to the department of buildings, and shall appoint, and may remove according to law, all subordinate officers and assistants in his department. All subordinate officers, assistants, clerks and employes in said department shall be subject to such rules and regulations as shall be prescribed from time to time by said commissioner.

(b) The Commissioner of Buildings shall institute such measures and prescribe such rules and regulations for the control and guidance of his subordinate officers and employes as shall secure the careful inspection of all buildings which in process of construction, alteration, repair or removal and the strict enforcement of the several provisions of this chapter.

(c) It shall be the duty of said commissioner and his assistants to enforce all ordinances relating to the erection, construction, alteration, repair, removal or the safety of buildings.

(d) *In all cases where any action is taken by the Commissioner of Buildings to enforce the provisions of any of the sections continued in this chapter or to enforce the provisions of any of the building ordinances of the city now or at any time hereafter in force, whether such action is taken in pursuance of the express provisions of such sections or ordinances or in a case where discretionary power is given by the ordinances of said city to the Commissioner of Buildings, such acts shall be done in the name of and on behalf of the City of Chicago, and the said Commissioner of Buildings in so acting for the city shall not render himself liable personally, and he is hereby relieved from all personal liability, for any damage that may accrue to persons or property as a result of any such act permitted in good faith in the discharge of his duties, and any suit brought against the said Commissioner of Buildings by reason thereof shall be defended by the Department of Law of said city until the final termination of the proceedings therein.*

**Paragraph (d) added December 18, 1911.*

(d) 201. Inspection of all Buildings in General Use—Precautions in Behalf of Public Safety—May Require Repair or Alteration in Such Cases—Interpretation of this Chapter. (a) The Commissioner of Buildings shall inspect or cause to be inspected all

public school buildings, public halls, churches, theaters, buildings used either for manufacturing or commercial purposes, hotels, apartment houses and other buildings or structures occupied or frequented by large numbers of people, for the purpose of determining the safety of such buildings, or any parts or appliances or equipment thereof; the sufficiency of their doors, passageways, aisles, stairways, corridors, exits or fire escapes and generally their facilities for egress in case of fire or other accidents, and the strength of their floors, and he shall make return of all violations of the several provisions of this chapter to the Law Department for prosecution.

(b) It shall be the duty of the Commissioner of Buildings, when any citizen represents that combustible materials are kept in any place in the city in an insecure manner, or that the doors, stairways, corridors, exits or fire escapes in any factory or workshop or other place of employment are insufficient for the escape of employees in case of fire, panic or accident, or do not comply with the provisions of this Chapter; or that the funnels, flues, fire boxes, or heating apparatus in any building in the city are insecure or dangerous, or that any part of any building in the city is in an unsafe or dangerous condition or in any wise in contravention of this Chapter, to make an examination of such place or building, and if such representation is found to be true, said Commissioner shall give notice in writing to the owner, occupant, lessee, or person in possession, charge or control of such place or building to make such changes, alterations or repairs as safety or the ordinance of the City may require. Upon failure of parties so notified to comply with said notice the matter shall be placed in the Law Department for prosecution.

(c) It shall be unlawful to continue the use of such building until the changes, alterations or repairs found necessary by the Commissioner of Buildings to make such building or part thereof safe or to bring it into compliance with this Chapter, shall have been made.

(d) The Commissioner of Buildings shall have full power to pass upon any question arising under the provisions of this chapter, subject to the conditions, modifications, and limitations contained therein.

202. Buildings Found in Unsafe Condition—Notice to Owner—Authority of Commissioner. (a) Whenever the Commissioner of Buildings shall find any building, or structure or part thereof in the city in such an unsafe condition as to endanger life but in such condition that by the immediate application of precautionary measures such danger may be averted, he shall have authority, and it shall be his duty, to forthwith notify, in writing, the owner, agent or person in possession, charge or control of such building or structure or part thereof, to adopt and put into effect such precautionary measures as may be necessary or advisable in order to place such building or structure or part thereof in a safe condition; such notice shall state briefly the nature of the work required to be done and shall specify the time within which the work required to be done shall be completed by the person, firm or corporation notified, which shall be fixed by said Commissioner of Buildings, upon taking into consideration the condition of such building or structure or part thereof, and the danger to life or property which may result from its unsafe condition.

(b) Whenever such Commissioner of Buildings shall be unable to find the owner of such building, structure or part thereof, or any agent or person in possession, charge or control thereof, upon whom such notice may be served, he shall address, stamp and mail such notice to such person or persons

at their last known address, and in addition thereto shall place or cause to be placed the notice herein provided for upon such building at or near its principal entrance, and shall also post or cause to be posted in a conspicuous place at each entrance to such building, in large letters, a notice as follows:

"THIS BUILDING IS IN A DANGEROUS CONDITION AND HAS BEEN CONDEMNED BY THE COMMISSIONER OF BUILDINGS."

(c) It shall be unlawful for any person, firm or corporation to remove said notice or notices without written permission from the Commissioner of Buildings.

(d) If at the expiration of the time specified in such notice for the completion of the work required to be done by the terms of such notice, in order to render the building or structure safe, said notice shall not have been complied with, and said building or structure is in such an unsafe condition as to endanger life or property, it shall be the duty of the Commissioner of Buildings to proceed forthwith to tear down or destroy that part of said building or structure that is in such unsafe condition as to endanger life or property, and in cases where an unsafe building or structure cannot be repaired or rendered safe by the application of precautionary measures, such building or structure, or the dangerous parts thereof, shall be torn down by said Commissioner of Buildings or by his order and the expense of tearing down any part of such building or structure shall be charged to the person owning or in possession, charge or control of such building or structure or part thereof, and the said commissioner shall recover or cause to be recovered from such owner or person in possession, charge or control thereof the cost of doing such work, by legal proceedings prosecuted by the Law Department.

(e) If the owner, agent or person in possession, charge or control of such building or structure, or part thereof, when so notified, shall fail, neglect or refuse to place such building or structure, or part thereof, in a safe condition, and to adopt such precautionary measures as shall have been specified by said commissioner within the time specified in such notice, in such case, at the expiration of such time it shall be unlawful for any person, firm or corporation to occupy or use said building or structure, or any part thereof, until said building or structure or part thereof is placed in a safe condition, and in case where a building or structure, or part thereof, is in a dangerous or unsafe condition and has not been placed in a safe condition within the time specified in the notice of the Commissioner of Buildings, such building or structure, or such part thereof, shall be forthwith vacated, and it shall be unlawful for any person or persons to enter same except for the purpose of making repairs required by the Commissioner of Buildings and the ordinances of the City of Chicago.

203. Building or Part of Building Constructed or Being Constructed in Violation of Chapter—Authority of Commissioner to Tear Down. (a) Whenever it shall be found that any building or structure, or part thereof, is being, or shall have been constructed or built in violation of any of the provisions of this chapter, the Commissioner of Buildings shall forthwith notify the owner, agent, superintendent or architect of, or the contractor engaged in erecting such building or structure, or part thereof, of the fact that such building or structure, or part thereof, has been, or is being, constructed or erected contrary to the provisions of this chapter and shall specify briefly in such notice in what manner the provisions of this chapter or any of them, have been violated, and shall re-

quire the person so notified to forthwith make such building, structure, or part thereof, conform to and comply with the provisions of this chapter, specifying in such notice the time within which such work shall be done.

(b) If, at the expiration of the time set forth in such notice, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and to have such building or structure, or part thereof, concerning which notice was sent, changed so as to conform to and comply with the provisions of this chapter, the Commissioner of Buildings shall have the authority, and it shall be his duty to proceed forthwith to tear down or cause to be torn down such building or structure, or such part thereof as shall or may have been erected and constructed in violation of the provisions or any of the provisions of this chapter, and the cost of such work shall be charged to and recovered from the owner of such building or structure or from the person for whom such building or structure is being erected, in legal proceedings prosecuted by the Law Department.

204. May Direct Fire Department to Remove.) The Commissioner of Buildings shall have authority to direct the Fire Marshal to tear down any defective or dangerous wall or structure or any building or structure or part thereof which may be constructed in violation of the terms of this chapter, after written notice has been served upon the owner, lessee, occupant, agent or person in possession, charge or control, directing him or them to tear down or remove any defective wall, building or structure, or any part thereof, which is in a dangerous condition, which has been, or is being, constructed or maintained in violation of the terms of this chapter. In case of the destruction or partial destruction of buildings by fire, decay or otherwise, when any department of the city government, pursuant to the ordinances of the city, shall make an outlay of money or incur any liability for the payment of any expense on behalf of the city in an effort to preserve or prevent the destruction of such building or buildings, or structure, or for the preservation of life of its citizens, it shall be the duty of the Commissioner of Buildings to ascertain the amount of such outlay or expenditure and present a bill therefor to the owner or owners of any such building or buildings, or its or their agent or agents, and it shall be the duty of said Commissioner of Buildings to refuse to issue a permit for the construction, re-construction, alteration or repair of any building or buildings or structure by any such owner or owners, lessee, occupant, agent or person in possession, charge or control thereof until such outlay or expenditure shall be repaid to the city by the owner, lessee, occupant, agent or person in possession, charge or control of such building or buildings thus totally or partially destroyed in the manner aforesaid. Said commissioner shall also proceed forthwith to collect the amount of such bill from such owner or owners, by legal proceedings prosecuted by the Law Department.

205. May Stop Construction and Wrecking of Buildings.) (a) Said commissioner shall have power to stop the construction of any building or the making of any alterations or repairs of any building within said city when the same is being done in a reckless or careless manner or in violation of any ordinance, and to order, in writing or by parole, any and all persons in any way or manner whatever engaged in so constructing, altering or repairing any such building, to stop and desist therefrom.

(b) And the said commissioner shall have power to stop the wrecking or tearing

down of any building or structure within said city when the same is being done in a reckless or careless manner or in violation of any ordinance or in such a manner as to endanger life or property, and to order any and all persons engaged in said work to stop and desist therefrom. When such work has been stopped by the order of said commissioner, it shall not be resumed until said commissioner shall be satisfied that adequate precautions will be taken for the protection of life and property, and that said work will be prosecuted carefully and in conformity with the ordinances of the city.

206. Arbitration—Appeal from Decision.)

(a) In all cases where discretionary power is given to the Commissioner of Buildings to estimate damage to buildings, as also in questions relating to the security of any building or buildings or structures, or part thereof, and in all other cases where discretionary powers are given by ordinance to the Commissioner of Buildings, any party or parties believing themselves injured or wronged by the decision of the Commissioner of Buildings must, before instituting any suit, make an appeal for arbitration as follows, to-wit:

(b) Any person wishing to make an appeal shall do so within five days after written notice of the decision or order of the Commissioner of Buildings has been given. An appeal made later than five days after the serving of the notice of the Commissioner of Buildings shall not entitle the appellant to any arbitration. The request for arbitration shall be in writing and shall state the object of the proposed arbitration and the name of the person who is to represent the appellant as arbitrator.

(c) The Commissioner of Buildings shall thereupon inform the appellant of the cost of such arbitration and such appellant shall, within twenty-four hours from the receipt of such information, deposit with the Commissioner of Buildings the sum of money requested for defraying the expense of the same, which sum shall be fixed in each case by said commissioner in proportion to the time it will take and the difficulty and importance of the case, but shall in no case be more than the cost of similar service in the course of ordinary business of private individuals or corporations. As soon as such sum of money shall have been deposited with him, the Commissioner of Buildings shall appoint an arbitrator to represent the city and the two arbitrators thus chosen shall, if they cannot agree, select a third arbitrator, and the decision of any two of these arbitrators shall, after investigation and consideration of the matter in question, be final and binding upon the appellant as well as the city unless an appeal is taken therefrom, as provided in case of an appeal under a statutory arbitration, within five days thereafter.

207. Arbitrators to Take Oath—Power to Examine Witnesses.) The arbitrators shall themselves, before entering upon the discharge of their duties, be placed under oath by the City Clerk, to the effect that they are unprejudiced as to the matter in question and that they will faithfully discharge the duties of their position. They shall have the power to call witnesses and place them under oath, and their decision or award shall be rendered in writing, both to the Commissioner of Buildings and to the appellant. The fee deposited by the appellant with the Commissioner of Buildings shall be paid by the Commissioner of Buildings to the arbitrators upon the rendering of their report and shall be in full of all costs incident to the arbitration; but should the decision of said board of arbitration be rendered against the Commissioner of Buildings, then the money deposited by the

aforesaid appellant shall be returned to him and the entire cost of such arbitration shall be paid by the city.

208. In Urgent Cases—Commissioner's Power Final.) Whenever the decision of the Commissioner of Buildings upon the safety of any building or any part thereof is made in a case which is so urgent that failure to properly carry out his orders to demolish or strengthen such building or part thereof may endanger life and limb, the decision and order of the Commissioner of Buildings shall be absolute and final.

209. Duty of Police to Assist Commissioner in Enforcing Provisions of this Chapter.) Whenever it shall be necessary, in the opinion of the Commissioner of Buildings, to call upon the Department of Police for aid or assistance in carrying out or enforcing any of the provisions of this chapter, he shall have the authority so to do, and it shall be the duty of the Department of Police, or of any member of said department, when called upon by said commissioner, to act according to the instructions of, and to perform such duties as may be required by said commissioner in order to enforce or put into effect the provisions of this chapter.

210. Certificates—Notices—Register.) (a) The Commissioner of Buildings shall sign or cause to be signed all certificates and notices required to be issued from the Department of Buildings and shall keep a record of the same, and shall issue or cause to be issued all permits authorized by this chapter.

(b) He shall also keep a proper record of all transactions and operations of the department and such record shall be at all times open to the inspection of the Mayor, Comptroller, Superintendent of Police, Fire Marshal and members of the City Council.

211. Must Keep Account of Fees Paid—Annual Reports and Estimates.) (a) Said commissioner shall keep in proper books for that purpose an accurate account of all fees charged, giving the name of person to whom same is charged, date on which said charge is made, and the amount of each such fee.

(b) He shall also, annually, on or before the first day of February in each year prepare and present to the City Council a report showing the receipts and expenditures and entire work of the Department of Buildings during the previous fiscal year and he shall on or before November first of each year prepare and submit to the Comptroller an estimate of the whole cost and expense of providing for and maintaining his office during the ensuing fiscal year.

212. Examination and Approval of Plans—Record of Inspections and Complaints.) The Commissioner of Buildings and his assistants shall pass upon all questions relating to the strength and durability of buildings or structures; shall examine and approve all plans before a permit is issued for the construction of any building or structure. The Commissioner of Buildings shall cause to be kept a complete record showing the location and character of every building or other structure for which a permit is issued and shall cause to be filed every report of inspection made on such building, which reports shall bear the signatures of the inspectors making such inspections. He shall cause to be kept a record of all complaints of violations of the building laws and shall cause all such complaints to be investigated.

***213. Deputy Commissioner of Buildings—Duty.)** (a) There is hereby created the office of Deputy Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person

certified to fill this office shall be either a civil, structural or architectural engineer or an architect, an experienced building contractor or an efficient building mechanic with at least five years' experience and training.

(b) The Deputy Commissioner of Buildings shall act as Commissioner of Buildings in the absence of the Commissioner of Buildings from his office and while so acting shall discharge all the duties and possess all the powers imposed upon or vested in the Commissioner of Buildings.

(c) The deputy commissioner of buildings shall, under the direction of the Commissioner of Buildings, have general control of all matters and things pertaining to the work of the Department of Buildings and shall perform such other duties as may be required of him by the Commissioner of Buildings.

*Paragraph (c) amended February 20, 1911.

214. Engineer in Charge—Duties.) (a) There is hereby created the office of Engineer in Charge, of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this position shall be a civil, structural, or architectural engineer of at least five years' experience and training.

(b) The Engineer in Charge shall be in immediate charge of the engineering work and staff of the Department of Buildings. The examination of plans submitted for the purpose of obtaining a permit, except as to matters elsewhere expressly assigned by law to some other department of the city government, shall be the duty of the Engineer in Charge and the engineering staff under his charge. The approval and stamp of the Engineer in Charge shall be required on the plans for the erection, enlargement, alteration, repair or removal of every building before a permit for such erection, enlargement, alteration, repair or removal shall be issued. The Engineer in Charge shall have charge of all tests of materials and systems of construction submitted for the approval of the Commissioner of Buildings. The Engineer in Charge shall pass upon the number, location, width and design of all fire-escapes required for new buildings, and he shall also pass upon the number, location, width and design of fire-escapes to be erected on existing buildings wherever such existing buildings are being enlarged, altered or remodeled under a building permit issued for such enlargement, alteration or remodeling. He shall perform such other duties as may be required of him by the Commissioner of Buildings.

215. Assistant Engineer in Charge—Duties.) (a) There is hereby created, the office of Assistant Engineer in Charge, of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this position shall be a civil, structural or architectural engineer of at least five years experience and training.

(b) In the absence of the Engineer in Charge, the Assistant Engineer in Charge shall act as Engineer in Charge. The Assistant Engineer in Charge shall perform such other duties as may be required of him by the Engineer in Charge.

216. Engineering Staff.) (a) The Commissioner of Buildings shall appoint according to law at least four Architectural Engineers, and such other engineers and assistants as the City Council may by ordinance provide, for service on the engineering staff of the Department of Buildings. Every person certified to fill the position of Architectural Engineer shall be a civil, structural or architectural engineer of at least five years' training and experience.

(b) The Architectural Engineers shall, under the direction of the Engineer in Charge, examine all plans submitted for the

purpose of obtaining a permit. They shall also examine and verify the figures on all floor load placards before such placards are approved for posting. They shall perform such other duties as may be required of them by the Engineer in Charge.

217. Building Inspector in Charge—Duties.) (a) The office of Assistant Deputy Commissioner of Buildings is hereby abolished and in lieu thereof there is hereby created the office of Building Inspector in Charge of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this position shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction.

(b) In the absence of the Commissioner of Buildings and the Deputy Commissioner of Buildings from their offices the Building Inspector in Charge shall act as Commissioner of Buildings, and while so acting he shall discharge all of the duties and possess all of the powers imposed upon or vested in the Commissioner of Buildings.

(c) He shall have immediate charge of the periodical inspection of buildings and of the inspection of buildings and structures being erected, enlarged, altered or repaired, excepting only such inspection as is expressly assigned to the elevator or fire-escape inspectors or is by law assigned to some other department of the city government.

218. Assistant Building Inspectors In Charge.) (a) The Commissioner of Buildings shall appoint, according to law, at least four Assistant Building Inspectors in Charge.

(b) Every person certified to fill the position of Assistant Building Inspector in Charge shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Assistant Building Inspectors in Charge shall have immediate charge of the several districts assigned to them by the Commissioner of Buildings and shall perform such other duties as the Commissioner of Buildings shall require them.

219. Building Inspectors.) (a) The Commissioner of Buildings shall appoint according to law such Building Inspectors as may be necessary.

(b) Every person certified to fill the position of Building Inspector shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Building Inspectors shall, under the direction of the Building Inspector in Charge, examine all buildings and structures in the course of erection, enlargement, alteration, repair or removal, as often as is required for efficient supervision, and shall make such periodical examinations of existing structures as shall be assigned to them. They shall examine all buildings, structures and walls reported to be in dangerous condition. They shall examine all buildings and other structures for the enlarging, altering, raising or removing of which, application for permit shall be made.

(c) Every building inspector shall make written reports daily to the Commissioner of Buildings as to the condition in which he found each building examined and as to violations, if any, of the ordinances which the Commissioner of Buildings is required to enforce, together with the street and number of the premises where such violations, if any, were found, the names of the owner,

agent, lessee and occupant thereof, and of the architect and the contractor engaged in and about the work in question. The Building Inspectors shall perform such other duties as may be required of them by the Commissioner of Buildings.

220. Elevator Inspector in Charge.) (a) There is hereby created the office of Elevator Inspector in Charge. He shall be appointed by the Commissioner of Buildings according to law.

(b) The person certified to fill the position of Elevator Inspector in Charge, shall be a graduate in engineering from a recognized technical school, shall be versed in the essentials of both mechanical and electrical engineering and shall have had at least five years experience in shop or construction work.

(c) The Elevator Inspector in Charge shall examine all plans for the installation of elevators and for the installation of mechanical devices and apparatus in theaters, amusement parks and the like, and, no such elevator, mechanical device or apparatus shall be installed or operated without the approval of the Elevator Inspector in Charge. The Elevator Inspector in Charge shall cause such inspection to be made of all new installations, as may be necessary to insure the carrying out of the approved plans and shall cause such periodic inspection to be made of existing installations of such mechanisms, devices and apparatus, as may be required by the Commissioner of Buildings, and shall perform such other duties as may be required of him by the Commissioner of Buildings.

221. Elevator Inspectors.) (a) The Commissioner of Buildings shall appoint according to law such Elevator Inspectors as may be necessary.

(b) Every person certified to fill the position of Elevator Inspector shall be a mechanical engineer, machinist or elevator builder, and shall be well grounded in the rudiments of mechanical and electrical engineering.

(c) The Elevator Inspectors shall inspect all elevators and such other mechanisms, devices and apparatus as shall be assigned to them by the Inspector in Charge, both existing and in process of being erected or installed, together with all the equipment and enclosures thereof. They shall make written reports daily to the Commissioner of Buildings as to the condition in which they find the elevators, equipment, enclosures, mechanisms, devices and apparatus, inspected by them, and of any violations of the requirements of this Chapter pertaining to such matters, together with the street and number of the premises where such violations, if any, occur, the names of the owner, agent, lessee and occupant thereof, and of the architect and contractor engaged in or about the construction and installation of such elevators, equipment, enclosures, mechanisms, devices or apparatus. They shall perform such other duties as may be required of them by the Commissioner of Buildings.

222. Fire-escape Inspector in Charge.) (a) There is hereby created the office of Fire-escape Inspector in Charge. He shall be appointed by the Commissioner of Buildings according to law.

(b) The person certified to fill the position of Fire-escape Inspector in Charge shall be a civil, structural or architectural engineer, or a man who has had not less than five years' experience in the design and erection of structural steel or in the design and construction of fire-escapes, and he shall be qualified to make all necessary computations as to the strength of any fire-escape, the design of which may be submitted for approval and to pass upon the relative merits of such various types of design as may be so submitted.

(c) The Fire-escape Inspector in Charge shall have immediate charge of the inspection of the erection of all fire-escapes and of the periodic inspection of fire-escapes, and shall pass upon the number, location, width and design of fire-escapes to be erected upon existing buildings, except where the existing building is being enlarged, altered or remodeled under a building permit issued for such enlargement, alteration or remodeling, in which case the Engineer in Charge shall pass upon the number, location, width and design of all fire-escapes required for new buildings. The Fire-escape Inspector in Charge shall also perform such other duties as may be required of him by the Commissioner of Buildings.

223. Fire-escape Inspectors.) (a) The Commissioner of Buildings shall appoint according to law such Fire-escape Inspectors as may be necessary.

(b) Every person certified to fill the position of Fire-escape Inspector shall be a person who has had at least four years' experience in superintending the erection of buildings, or in the design or erection of fire-escapes or other steel construction, or who is a graduate of a recognized technical school.

(c) The Fire-escape Inspectors shall, under the direction of the Fire-escape Inspector in Charge, inspect all fire-escapes in course of erection and shall make periodic inspection of the fire-escape equipment of existing buildings. Every such inspector shall make, daily, a written report to the Commissioner of Buildings as to the condition of the fire-escape equipment of each building or premises examined, as to the accessibility of and means of egress to such equipment, as to the presumptive adequacy of such equipment, and as to any violations of any ordinance in relation to such equipment, together with the street and number of the building or premises inspected, the names of the owner, agent, lessee and occupant thereof and of the architect and contractor, if any, engaged in operation in connection with such equipment. The Fire-escape Inspectors shall perform such other duties as may be required of them by the Commissioner of Buildings.

224. Secretary—Duties.) (a) There is hereby created the office of Secretary to the Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law.

(b) The Secretary to the Commissioner of Buildings shall, under the supervision and direction of the Commissioner of Buildings, preserve and keep all books, records and papers belonging to the office of the Department of Buildings or which are required by law to be filed therein. He shall perform such other duties as may be required of him by the Commissioner of Buildings.

225. Clerical Assistants.) The Commissioner of Buildings shall appoint according to law, such clerical assistants, stenographers and messengers as may be necessary; and they shall perform such duties as may be required of them by the Commissioner of Buildings.

226. Bonds.) The Deputy Commissioner of Buildings, the Engineer in Charge, the Assistant Engineer in Charge, the Building Inspector in Charge, the Assistant Building Inspectors in Charge, the Elevator Inspector in Charge, the Fire-escape Inspector in Charge and the Architectural Engineers shall, before entering upon the duties of their offices or positions, each execute to the City of Chicago a bond, conditioned for the faithful performance of their duties, with such sureties as the City Council shall approve in the following sums: The Deputy

Commissioner of Buildings, ten thousand dollars; the Engineer in Charge, the Assistant Engineer in Charge, the Building Inspector in Charge, the Assistant Building Inspectors in Charge, the Elevator Inspector in Charge, the Fire-escape Inspector in Charge, and the Architectural Engineers, five thousand dollars each.

227. Employees Not to Engage in Another Business.) Every employee in the Department of Buildings shall devote his entire time to such employment and shall not be engaged in any other business or vocation.

228. Power of Entry.) The Commissioner of Buildings and his Assistants are empowered to enter any building or structure or premises, whether completed or in process of erection, for the purpose of determining whether the same has been or is being constructed and maintained in accordance with the provisions of this chapter and it shall be unlawful to exclude them from any such building, structure or premises.

ARTICLE II.

229. Permits—When Required—Limitations of Time For.) Before proceeding with the erection, enlargement, alteration, repair or removal of any building or structure in the city, a permit for such erection, enlargement, alteration, repair or removal shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the erection, enlargement, alteration, repair or removal of any building or of any structural part thereof within the city unless such permit shall first have been obtained from the Commissioner of Buildings. And if after such permit shall have been granted, the operations called for by the said permit shall not be begun within six months after the date thereof, or if such operations are not completed within a reasonable time then such permit shall be void, and no operations thereunder shall be begun or completed until an extended permit shall be taken out by the owner or his agent, and a fee of ten per cent. of the original cost of permit shall be charged for such extended permit.

***230. Permits—Application For—How Made—How Recorded—Stamped Plans—How Cared For—Return of Same to Depositor—Cornices Projecting Beyond Building Line—Plans and Permits to be Kept on Job While Work Is in Progress.)** (a) Application for building permits shall be made by the owner or his agent to the Commissioner of Buildings. When such application is made, plans in conformity with the provisions of this chapter, which have been examined and approved by the Commissioner of Buildings and his assistants, as hereinbefore provided for, shall be filed with the Commissioner of Buildings. He shall then issue a permit, and shall file such application, and shall apply to such plans a final official stamp, stating that the drawings to which the same has been applied comply with the terms of this chapter. The plans so stamped shall then be returned to such applicant. True copies of so much of such plans as may be required in the opinion of the Commissioner of Buildings to illustrate the features of construction and equipment of the building referred to, shall be filed with the Commissioner of Buildings, and shall remain on file in his office for a period of six months after the occupation of such building, after which such drawings shall be returned by the Commissioner of Buildings to the person by whom they have been deposited with him, upon demand. It shall not be obligatory upon the Commissioner of Buildings to retain such drawings in his custody for more than six months after the occupation of the building to which they relate.

(b) All plans and drawings for the construction or alteration of any building or other structure for which building permits are required shall, before such permits are issued, be presented to the Commissioner of Health for examination and approval as to the proposed plan for the ventilation of rooms, light and air shafts, windows, the ventilation of water closets, drainage and plumbing. They shall also be presented to the Chief of Fire Prevention and Public Safety for approval. They shall also be presented to the Boiler Inspector and Smoke Inspector in all cases where permits from these departments are required to be procured by the ordinances of the city.

(c) The Commissioner of Buildings shall not issue any permit authorizing the construction, erection, repair or alteration of any building or structure unless the plans submitted for his approval clearly show that such building or structure with all its appurtenances, foundations and attachments can be erected entirely within the limits of the lot or tract of land upon which it is proposed to erect such building or structure, except as hereinafter provided and except as provided by the ordinances of the City of Chicago, and no permit to erect, repair or alter any building or structure shall authorize the use of any part of any public highway or other public ground for the construction or maintenance of such building or structure except as hereinafter provided and except as provided by the ordinances of the City of Chicago, nor shall any permit be issued for the construction or maintenance of any balcony or canopy extending over any public highway or other public ground unless permits therefor have been obtained from the proper department of the city government pursuant to an ordinance specifically authorizing the same. The plans of every building or structure which show that any part of said building or structure or any of its appurtenances, or attachments thereto, extend over any part of any public highway or other public ground other than hereinafter provided for shall, previous to being submitted to the Commissioner of Buildings, be submitted to the Commissioner of Public Works and notice thereby given to him of the proposed encroachment upon any public highway or other public ground. Proof of such notice to the Commissioner of Public Works must accompany plans when same are presented to the Commissioner of Buildings.

The Commissioner of Buildings may issue permits for horizontal cornices and belt courses so called to be constructed on buildings as follows:

Where all parts of a cornice of any building or structure are more than twelve feet above the inside grade of the sidewalk, and where the sidewalk grade varies, are more than twelve feet above the average or mean inside grade of the sidewalk and where such cornice extends in whole or in part along the street frontage of a building, and where the return of such cornice if any along an alley wall is not longer than a distance equal to the width of the alley, such cornice may project into the street or alley a distance of twenty-four inches. For each additional one foot in height such cornice is placed above the height of twelve feet as aforesaid up to the limits of height fixed by ordinances for the particular building of which such cornice is a part, such cornice may project into the street or alley an additional one-quarter inch, until the total projection has reached the maximum of four feet six inches where the width of the street is less than sixty-six feet; and to a maximum of five feet where the width of the street is sixty-six feet or more.

Horizontal belt courses, water tables and other horizontal architectural features, which do not add floor area to a building or structure and which extend in whole or in part along the street frontage of a building with a return if any around an alley wall not longer than a distance equal to the width of the alley, and where all parts of such horizontal belt courses, water tables and other horizontal architectural features are more than twelve feet above the inside grade of the sidewalk, may project into the street or alley a distance not to exceed eighteen inches.

In addition to the general plan of the building or structure as required in other sections of this

ordinance, a detailed plan drawn to a large scale of any proposed cornice or any projection contemplated in this section, shall be submitted to the Commissioner of Buildings for his examination and approval.

*See page 194 for amendment pertaining to plans.

(d) The Commissioner of Buildings shall not issue any permit authorizing the construction, erection, repair or alteration of any building or structure unless the plans submitted for his approval clearly show that such building or structure with all its appurtenances, foundations and attachments can be erected entirely within the limits of the lot or tract of land upon which it is proposed to erect such building or structure, except as provided by the ordinances of the City of Chicago, and no permit to erect, repair or alter any building or structure shall authorize the use of any part of any public highway or other public ground for the construction or maintenance of such building or structure, except as provided by the ordinances of the City of Chicago, nor shall any permit be issued for the construction or maintenance of any balcony or canopy extending over any public highway or other public ground unless permits therefor have been obtained from the proper department of the city government pursuant to an ordinance specifically authorizing the same. The plans of every building or structure which show that any part of said building or structure or any of its appurtenances, or any attachments thereto, extend over any part of any public highway or other public ground shall first be submitted to the Commissioner of Public Works and notice thereby given to him of the proposed encroachment upon any public highway or other public ground. Proof of such notice to the Commissioner of Public Works must be presented to the Commissioner of Buildings before a permit for any such building or structure shall be issued by said Commissioner of Buildings; and no permit issued by the Commissioner of Buildings shall authorize any encroachment upon any part of any public highway or other public ground.

(e) In all cases, the approved plan, together with building permits, must be kept on the job while the work is in progress.

*Amended February 21 and April 7, 1916.

231. Plans—Essentials Of.) All such plans and drawings shall be drawn to a scale of not less than one-eighth of an inch to the foot, on paper or cloth, in ink, or by some process that will not fade or obliterate. All distances and dimensions shall be accurately figured, and drawings made explicit and complete, showing the lot lines and the entire sewerage and drain pipes and the location of all plumbing fixtures within such building. Each set of plans presented shall be approved by the Commissioner of Buildings before a permit will be granted. No permit shall be granted or plans approved unless such plans are signed and sealed by a licensed architect as provided in "An Act to provide for the licensing of architects and regulating the practice of architecture as a profession in the State of Illinois," approved June 3, 1897.

232. Plans—Alterations Upon Stamped Plans Not Permitted Without Permission—Certain Alterations Excepted.) It shall be unlawful to erase, alter or modify any lines, figures, or coloring contained upon such drawings so stamped by the Commissioner of Buildings or filed with him for reference. If, during the progress of the execution of such work, it is desired to deviate in any manner affecting the construction or other essentials of the building from the terms of the application, or drawing, notice of such intention to alter or deviate shall be given to the Commissioner of Buildings, and his written assent shall first be obtained before such alteration or deviation may be made; but alterations in buildings which do not involve any change in their structural parts or of their stairways, elevators, fire-escapes or other means of communication or ingress or egress or in lighting or ventilation and

that are not in violation of any of the provisions of this chapter, may be made without the permission of the Commissioner of Buildings.

233. Deposit With Water Department—How Made—Indemnifying Bonds—Fees for Water Used.)

(a) Before the Commissioner of Buildings issues a permit as aforesaid he shall require evidence from the applicant that payment has been made to the Bureau of Water of the city for the water to be used or for a water meter for measuring all the water to be used in the construction of such building, under the regulations of the Bureau of Water. Such applicant shall produce evidence that he has filed with and had approved by the Commissioner of Public Works of the city an indemnifying bond protecting the city against any and all damage that may arise to the streets or alleys upon which such building abuts, and to the city and to any person in consequence, or by reason of, the proposed operations to be authorized by such permit, or by reason of any obstruction or occupation of any street or sidewalk in and about such building operations.

(b) The fees to be paid for water used in connection with the erection of buildings shall be as follows, to-wit:

At the rate of five cents for every one thousand bricks, wall measure, used in connection therewith.

At the rate of six cents for every one hundred cubic feet of rubble stone used in connection therewith.

At the rate of eight cents for every one hundred cubic feet of concrete used in connection therewith.

At the rate of fifteen cents for every one hundred yards of plastering used in connection therewith.

At the rate of five cents for every one hundred cubic feet of hollow tile arch, partition or fireproof covering used in connection therewith.

***234 Amount of Permit Fees.)** (a) The fees to be charged for building permits shall be as follows: For sheds not exceeding three hundred square feet in area, Two Dollars; for open shelter sheds, at the rate of Fifty Cents for each one thousand cubic feet or fractional part thereof; for all buildings or other structures, other than sheds and open shelter sheds, as hereinafter described, the fee for the permit shall be at the rate of Ten Cents for every one thousand cubic feet or fractional part thereof contained therein, the cubic contents being measured to include every part of the building from the basement floor to the highest point of the roof, and to include all bay windows and other projections; but in no case, shall any permit be issued for a less fee than Two Dollars, except that a fee of One Dollar shall be charged for recovering or recoating the roof of any building.

(b) The fee to be charged for permits issued for alterations and repairs in or to any building or other structure shall be based on the cost of such alterations and repairs and shall be at the rate of Two Dollars for each Five Thousand Dollars or part thereof to be expended therefor. The fee for permit to raise any building other than a frame building shall be Two Dollars for every twenty-five feet or fractional part thereof of frontage.

(c) In addition to the above permit fees for buildings, permit and inspection fee shall be charged as follows:

For erection of fire escapes, \$2.00;
For installation or alteration of elevator, \$2.00;
For semi-annual inspection of elevator, \$2.00;
For erection of billboard or sign-board, \$2.00 for every 25 lineal feet or fractional part thereof;
For annual inspection of billboard or sign-board, 35 cents for each 25 lineal feet of billboard or sign-board or fractional part thereof;

For erection of illuminated and other roof signs under Section 710 of this Chapter, \$30.00 for the first 500 square feet of superficial area or fractional part thereof, and two cents for each additional square foot area.

For annual inspection of illuminated and other roof signs under Section 710 of this Chapter, \$50.00;

For tearing down or wrecking a building, \$2.00 for every 25 feet of frontage or fractional part thereof;

For annual inspection of building required to be inspected by Section 237 of this Chapter, \$2.00 for each 25,000 square feet or fractional part thereof;

For semi-annual inspection of iron or steel curtain, \$5.00;

For semi-annual inspection of asbestos curtain, \$2.00;

For permit for tank or tower on roof in excess of 400-gallon capacity, \$5.00;

For permit for isolated chimneys or for chimneys extending over fifty feet above the roof of any building, \$5.00.

*Attended February 20, 1911.

***235. Permit for Wrecking Building.)**

(a) Before proceeding with the wrecking or tearing down of any building or other structure more than one story in height or of any structure of greater area than 2,800 square feet, a permit for such wrecking or tearing down shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the wrecking or tearing down of any building or structure or any structural part of such building or structure unless such permit shall first have been obtained. Application for such permit shall be made by such owner or his agent to the Commissioner of Buildings who shall issue such permit upon such application and the payment of the fee herein provided for. Such application shall state the location and describe the building which it is proposed to wreck or tear down. The fee for such permit shall be Two Dollars for every twenty-five feet, or fractional part thereof, of frontage. Upon the issuance of such permit, such building may be wrecked or torn down, provided that all the work done thereunder shall be subject to the supervision of the Commissioner of Buildings and to such reasonable restrictions as he may impose in regard to elements of safety and health, and provided, further, that the work shall be kept sprinkled and sufficient scaffolding be provided to insure safety to human life.

(b) Before any permit is issued granting authority to wreck a building or structure for which permit is required, the person, firm or corporation engaged in the work of wrecking same shall file with the City Clerk a bond with sureties to be approved by the City Comptroller to indemnify, keep and save harmless the City against any loss, cost, damage, expense, judgment or liability of any kind whatsoever which the City may suffer, or which may accrue against, be charged to or be recovered from said city, or any of its officials, from or by reason or on account of accidents to persons or property during any such wrecking operations, and from or by reason or on account of anything done under or by virtue of any permit granted for any such wrecking operations. Such bond in each case shall extend to and cover all such wrecking operations carried on through permits obtained thereunder by such person, firm or corporation during any fiscal year beginning January first and ending December thirty-first, and no permit shall be issued for any wrecking work except as hereinbefore otherwise provided during such fiscal year until such bond is filed. Said bond shall be in the penal sum of twenty thousand dollars for all wrecking operations on such buildings and other structures not more than three stories in height, and there shall be an additional bond filed in the penal sum of twenty thousand dollars or a bond in the penal sum of forty thousand dollars shall be filed in the first instance in case of wrecking opera-

tions on buildings and other structures four or more stories in height. Upon the filing of such bond or bonds the person, firm or corporation engaged in the work of wrecking such buildings and other structures may obtain permits for such wrecking operations as are authorized under the said bond or bonds as hereinabove provided for during the fiscal year in which the same is or are filed: Provided, that, in case of accident or casualty in the progress of any wrecking operations carried on under any permit so issued, or the happening of any circumstance which might in the opinion of the Commissioner of Buildings render such bond or bonds inadequate, the said Commissioner may, in his discretion, require such additional bond as he may deem necessary to fully protect the city from loss resulting from the issuance of such permits before he allows the work to proceed or before any additional permits are issued by him.

*Amended January 12, 1914.

***236. Permit—Revocation of.)** If the work in, upon or about any building or structure shall be conducted in violation of any of the provisions of this chapter, it shall be the duty of the Commissioner of Buildings to revoke the permit for the building or wrecking operations in connection with which such violation shall have taken place. It shall be unlawful, after the revocation of such permit, to proceed with such building or wrecking operations unless such permit shall first have been re-instated or re-issued by the Commissioner of Buildings. Before a permit so revoked may be lawfully re-issued or re-instated, the entire building and building site shall first be put into condition corresponding with the requirements of this chapter, and any work or material applied to the same in violation of any of the provisions of this chapter shall be first removed from such buildings.

*Amended February 20, 1911.

237. Annual Inspection of Buildings—Stairways and Means of Egress—Inspection Fee.)

(a) The Commissioner of Buildings and his assistants shall make an annual inspection of all theatres and places of amusement, worship, instruction or entertainment, and also of other buildings over two stories in height, except residences, and except tenements three stories or less in height. It shall be the duty of every owner, agent, lessee or occupant of any such building as is referred to in this section and of the person in charge or control of the same to permit the making of such annual inspection by the Commissioner of Buildings, or by a duly authorized Building Inspector, at any time upon demand being duly made.

(b) Whenever any such inspection shows the building to be in compliance with the requirements of this Chapter with respect to stairways, means of egress, and in all other respects, it shall be the duty of the Commissioner of Buildings to issue, or cause to be issued, a certificate setting forth the result of such inspection, containing the date thereof, and a statement to the effect that such building complies in all respects with the provisions of this Chapter, upon the payment of the inspection fee herein required.

(c) It shall be the joint and several duty of the owner, agent, lessee or occupant of the building so inspected and of each and every person in charge and control of the same to frame the said certificate and place it in a conspicuous place near the main entrance of such building.

(d) It shall be the joint and several duty of the owner, agent, lessee or occupant of every building described in this section to provide a typical floor plan of such building reproduced on a sheet eight by ten inches in size. Said plan shall be drawn on as large a scale as will be practicable on such sheet, and said sheet shall also state the street address of such building, and shall give the class of the building, the kind of construction used therein, the height and

the number of stories contained therein, the nature of the occupancy, and whether said building is equipped with an approved automatic sprinkler system.

(e) It shall also be the joint and several duty of such owner, agent, lessee or occupant to deliver a copy of said sheet to the Commissioner of Buildings and to frame a copy of said sheet and place the same near the framed certificate hereinabove required.

(f) It shall also be the joint and several duty of the said owner, agent, lessee or occupant to substitute a new sheet for the sheet on file with the Commissioner of Buildings, and also the sheet framed as above required, whenever such changes or alterations are made in such building as will affect the substantial accuracy of the sheet previously furnished such Commissioner and framed as above required.

(g) Where the result of such inspection shall show that such building fails in any respect to comply with the requirements of this Chapter, it shall be the duty of the Commissioner of Buildings to notify the owner, agent, lessee or occupant of such building to this effect and to specify wherein such building fails to comply with the requirements of this chapter; and it shall thereupon become the joint and several duty of such owner, agent, lessee or occupant to proceed forthwith to make whatever changes or alterations may be necessary to make such building comply in all respects with the requirements of this chapter and to complete such changes and alterations within thirty days after the receipt of such notice.

(h) Upon making such annual inspection, it shall be the duty of the owner to pay to the City Collector an annual inspection fee for the same, amounting to \$2.00 for each 25,000 square feet of floor area, or fractional part thereof: *Provided however that no charge for such annual inspection shall be made against religious, charitable or educational institutions.*

238. Architect Must Certify That Plans Comply With the Building Ordinances.) It shall be unlawful for any architect, or other person permitted under the laws of the state to make plans, to prepare or submit to the Commissioner of Buildings for his approval any final plans for any building or structure which do not comply with the structural requirements of this chapter. It shall be the duty of the Commissioner of Buildings to require that all plans submitted to him for approval for any building or structure shall be accompanied by a certificate of such architect or such other person preparing such plans that the plans submitted comply with the structural requirements of this chapter.

***239. Constructing Buildings Contrary to Approved Plans—Permit Made Void by Deviation from Plans—Power to Stop Work.)**

(a) It shall be unlawful for any owner, agent or architect or for any contractor or builder engaged in erecting, altering or repairing any building, to make any departure from the plans as approved by the Commissioner of Buildings of such nature that such departure involves any violation of the requirements of this chapter as to buildings of the class in which such building is, or to make any changes in plans or construction affecting means of egress, ventilation, natural lighting, or sanitary conditions without first obtaining the written consent of the Commissioner of Buildings and of the Commissioner of Health to such changes. Any such departure from the approved plans involving a violation of the requirements of this chapter or any such change in the plans or construction without the consent of the Commissioner of Buildings and of the Commissioner of Health being obtained, as required herein, shall operate to annul the permit which has been issued for such work and shall render the same void.

(b) In case any work is done under a permit authorizing the erection, alteration or repair of a building or structure, which work is contrary to the approved plans, the Commissioner of Buildings or the Commissioner of Health and their assistants shall have power to at once stop such work and to order all persons engaged therein to stop and desist therefrom. Such work shall not be resumed until satisfactory assurance has been given the Commissioner of Buildings or the Commissioner of Health that it will be done according to the approved plans or until said Commissioner of Buildings or Commissioner of Health has consented, in writing, to the changes made in such approved plans, in either of which cases a new permit must be issued before the work proceeds, for which permit the usual fee shall be paid by the contractor doing such work.

(c) No contractor or builder shall begin any work on any building or structure for which a permit is required until such permit shall have been secured. In case any work is begun on the erection, alteration, repair or removal of any building or structure without a permit authorizing the same being issued therefor, the Commissioner of Buildings and his assistants shall have power to at once stop such work and to order any and all persons engaged therein to stop and desist therefrom until the proper permit is secured.

*Amended July 22, 1912.

ARTICLE III.

Classification of Buildings.

*240. **Buildings—Class Of.** (a) All buildings other than sheds and shelter sheds as hereafter described, now existing or hereafter erected, altered or enlarged, shall be classified as follows:

(b) **Class I.** In Class I shall be included every building other than department stores as described in this chapter, used for the sale, storage, or manufacture of merchandise, and every stable or garage having a ground area of 500 square feet or over.

*Amended February 20, 1911.

(c) **Class II.** In Class II shall be included every building referred to in subdivisions Class IIa, Class IIb and Class IIc.

(d) In Class IIa shall be included every building used for office purposes, and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

(e) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(f) In Class IIc shall be included every building used for a hospital, home for the aged and decrepit, for housing the sick and infirm, imbeciles or children, house of correction or detention, jail or asylum, where any such building shall have sleeping accommodations for more than ten persons.

*Amended May 8, 1916.

(g) **Class III.** In Class III shall be included every building used as a family residence, and also every building used for garage or stabling purposes, and having a ground area of less than 500 square feet.

(h) **Class IV.** In Class IV shall be included every building referred to in subdivisions Class IVa, Class IVb, Class IVc, and Class IVd, as follows:

(i) In Class IVa shall be included every building used as a church or place of worship.

(j) In Class IVb shall be included every building having a parish hall, Lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction other than schools, included in Class VIII, and also every existing building having a

hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(k) In Class IVc shall be included every building hereafter erected used for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred, provided, that every building of Class IVc existing at the time of the passage of this ordinance shall comply with the provisions of Class IVb.

(l) In Class IVd shall be included every grand stand and every baseball athletic and amusement park.

(m) **Class V.** In Class V shall be included every building which is used as a public theatre where an admission fee is charged and in which movable scenery is used, and every assembly hall hereafter erected having a seating capacity of over 300 and containing a permanent stage on which scenery and theatrical apparatus are used and regular theatrical vaudeville performances are given; provided, however, that public halls and club halls with a seating capacity of less than 600, although occasionally used for theatrical presentations, shall not be construed to be public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stages thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V as herein defined. Such public halls and club halls shall be included in Class IVb, as defined in this section.

(n) **Class VI.** In Class VI shall be included every tenement and apartment house or building or portion thereof which is used or intended to be used as a home or residence for two or more families living in separate apartments.

(o) **Class VII.** In Class VII shall be included every building used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as a department store.

(p) **Class VII.** In Class VIII shall be included every building used for school purposes and every building containing class rooms for special or general instruction, other than halls for the purpose of instruction as included in Class II, where such building so used shall have a seating capacity of more than fifty students.

*Paragraph (p) amended May 17, 1915.

(q) **Class IX.** In Class IX shall be included every building maintained by the City of Chicago for police station purposes.

*Class IX added May 8, 1916, and former paragraph (q) changed to (r). [See Article XI-a.]

(r) Requirements with regard to buildings not within any of the above classes shall be determined by the Commissioner of Buildings subject to arbitration in the same manner as provided in Sections 206 and 207 of this chapter.

241. **Buildings Used for the Purposes of More Than One Class.** Where any building is used for the purposes of two or more classes, as herein specified, and defined, such portion of any such building as is devoted to the uses and purposes of any particular class shall be constructed, operated and maintained in accordance with the requirements of this chapter relating to such class, unless such construction shall, in the opinion of the Commissioner of Buildings, prove impracticable, or unless there would be a conflict between the provisions of this chapter relating to the construction of buildings, in either of which cases the provisions which

relate to and govern the construction of buildings of the class requiring the best and safest form of construction shall govern the entire building.

242. Conflict Between Special and General Provisions.) Whenever any provision or requirement of this chapter relating specifically to the construction, equipment, maintenance, or operation of any building or part of a building used for the purposes of any specified class, shall conflict with the general provisions of this chapter relating to the construction, equipment, maintenance and operation of buildings generally, the special provisions shall govern in each case, except in the case of Section 514, which shall govern in all cases coming within the provisions.

ARTICLE IV.

Class I.

***243. Class I Defined.)** In Class I shall be included every building other than department stores, as described in this chapter, used for the sale, storage, or manufacture of merchandise, and every stable or garage having a ground area of 500 square feet or over.

**Amended February 20, 1911.*

243½. Must Comply With General and Special Provisions.) Every building of Class I shall comply with the general provisions of this chapter, and shall, in addition, comply with the following special provisions:

244. Buildings—Construction of—In Relation to Height.) (a) The construction of buildings of Class I shall be as follows: Buildings of Class I which are more than 90 feet in height shall be built of fireproof construction.

(b) Buildings of Class I which are less than 90 feet in height and more than 50 feet in height shall be built of slow-burning, mill or fireproof construction.

(c) Buildings of Class I of ordinary construction shall not be built more than four stories in height.

***245. Skeleton Steel Walls—Metal Lath and Solid Cement Plaster Covers.)** (a) A one or two story building used for the purposes of Class I, no part of which is within twenty feet of any lot line, alley line or street line, having a complete self-supporting steel frame consisting of wall columns, supporting steel trusses, with steel trusses and steel diagonals, designed to resist safely, within the safe limits of stress provided by this chapter, a wind pressure of twenty pounds per square foot, for each and every exterior surface exposed to the wind, in addition to the dead weight of the completed structure, and in addition to the live load of 100 pounds per square foot provided for by this chapter, and any other live loads which may be imposed on such structure, may have exterior walls measuring not less than one and one-third inches thick of metal lath or metal fabric plastered on both sides with a mortar consisting only of Portland cement and torpedo sand. Complete reinforced concrete framework, built in every manner equally as strong and as safe as provided for a steel frame, in this section, may have exterior walls built in the same manner, of the same materials and of the same thickness.

(b) The enclosing walls of buildings which are built not less than fifty feet from any lot, alley or street line may be constructed of corrugated iron, supported on a steel frame built as specified in this section.

Amended February 20, 1911.

***246. Door Openings—Revolving Doors.)** (a) The aggregate width of door openings at the street level in buildings of Class I shall be equal to the aggregate width of stairways, as specified in Section 666 of this chapter, and all locks used on exit doors or

on doors or gates leading to hallways or stairways which lead to exit doors, shall be so arranged that they may be opened from the inside without the use of a key, during business hours, or while such buildings are occupied for any purpose. In every building of this class, every door leading from a loft or space above the first story shall swing into the stair hall, and every door which is a means of exit from any floor above the first, shall swing outwardly from the space or hallway in which said stairway from such upper floor is located. No door when open shall project over a public sidewalk.

(b) *Revolving doors shall not be considered as complying with this section unless the revolving wings of such revolving doors are so arranged that, by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said doors fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than 22 inches on each side of said collapsed doors.*

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed, and all deficiency of required exits must be made up by additional doors.

**Amended February 20, 1911.*

247. Existing Buildings of Class I—Increasing Height of.) In all cases where buildings of Class I of ordinary construction built prior to the passage of this ordinance, are to be increased in height above the height of fifty feet, or of mill or slow-burning construction above the height of ninety feet, the additional parts of such buildings shall be constructed as herein provided for buildings over fifty feet in height or over ninety feet in height, respectively, and said additional parts shall be made to conform in all respects to the requirements for buildings of this class more than fifty feet in height or more than ninety feet in height, respectively, before it shall be lawful to occupy them.

248. Ceiling and Roof—Space Between.) In buildings of Class I, if the enclosed space between a ceiling and the roof is of greater average height than two feet, access shall be provided by means of at least one stairway not less than three feet wide, leading from a public hallway or corridor.

249. Fire Walls.) (a) Buildings occupied by more than one person, firm or corporation, or for more than one business enterprise conducted by the same person, firm or corporation, in separate enclosures on any one floor, shall have a brick dividing wall for every fifty feet of street frontage, if of ordinary construction, or for every eighty feet of street frontage, if of slow-burning or mill construction, and such dividing walls shall extend from the front to the rear wall and such dividing walls and the doors therein shall be built in accordance with the provisions of Section 573 of this chapter.

(b) All of the partitions between the parts of such buildings occupied by different persons, firms or corporations, shall be built of incombustible material from the floor to the floor boards or roof boards next above such story or stories so occupied.

(c) Only metal framed windows glazed with one-quarter inch thick wire glass may be used in such partitions.

***250. Dividing Walls—When Required.)** (a) Dividing walls will be required in buildings of Class I as follows:

(b) Every building of ordinary construction having a greater area than 9,000 square feet shall be divided into areas of 9,000 square feet or less by dividing walls; every building of slow-burning or mill construction more than one story in height having greater area than 12,000 square feet, shall be divided into areas of 12,000 square feet or less by dividing walls; provided, however, that buildings of slow-burning or mill construction more than one story in height and having in addition to the requirements of this ordinance relating to buildings of slow-burning and mill construction having areas not greater than 12,000 square feet, a frontage on at least two public thoroughfares, and having all stairways and elevator shafts and other floor openings enclosed with brick masonry walls with all openings in same protected with approved automatic fire doors and all stairhalls at street or ground level to open directly or through a fireproof tunnel to a street or public alley and equipped throughout on all floors and basement with an automatic sprinkler system meeting with the approval of the Chief of Fire Prevention and Public Safety may be built of an area of 16,000 square feet and if of greater area shall be divided into areas of 16,000 square feet or less by dividing walls.

Every fireproof building more than two stories in height and having greater area than 30,000 square feet, shall be divided into areas of 30,000 square feet or less by dividing walls.

*Amended March 30, 1914.

(c) Where dividing walls are required in any of the above mentioned buildings, such building shall be subdivided by brick walls, built of the thickness given in the table for the thickness of enclosing walls and all doors or other openings in such walls shall have at each side of the same, iron doors, tin clad doors or shutters, as described in Section 573 of this chapter, and said buildings as subdivided shall be provided with stairs and fire escapes the same as hereinafter required; provided, however, that one-story buildings of ordinary mill or slow-burning construction and two-story buildings of fireproof construction of any size when used as one store, room or workshop and occupied by only one person, firm or corporation, may be erected without any dividing walls.

***251. Display of Placard—Indicating Floor Strength.)** (a) It shall be the duty of the owner of every building of Class I now in existence or hereafter erected, or of his agent, or of the occupant, or person in possession, charge or control of same, to affix and display conspicuously on each floor of such building, a placard, stating the uniformly distributed load per square foot of floor surface, which may with safety be applied to that particular floor, as provided by this chapter, or if the strength of different parts of any floor varies, then there shall be such placards for each varying part of such floor. It shall be unlawful to load any such floors or any part thereof to a greater extent than the loads indicated upon such placards.

(b) It shall be the duty of the occupants of such buildings to maintain such placards during their occupation of the premises and of the owners of buildings, or their agents, to cause the same to be properly affixed with each change of occupation. It shall be the duty of the owner, agent or lessee of each such building, now in existence, as well as hereafter erected, to procure and submit evidence of the correctness of the figures on such placards to the Commissioner of Buildings. Whenever such evidence as to the correctness of the figures shall be satisfactory to the Commissioner of Buildings, he shall approve such placards. Such placards so approved by the Commissioner of Buildings shall then be affixed upon the respective floors of the different buildings. The calculations and loads shall be in accordance with the provisions of this chapter.

(c) It shall be the duty of the owner, agent or lessee to pay to the City Collector a fee amounting to five dollars (\$5.00) for each fifty thousand (50,000) square feet of floor area, or fractional part

thereof, for each building for which such placards are approved.

For the purpose of determining the amount of the fee herein required to be paid every part of a structure separated by dividing walls as required by Section 250 of this chapter shall be considered as a separate building.

*Amended May 12, 1913.

*Paragraph (c) (last half) added June 28, 1915.

***252 Live Loads for Floors.)** The floors of all buildings of Class I hereafter erected shall be designed and constructed in such a manner as to be capable of bearing, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface, and the strength of such building shall be increased above the capacity to carry such a live load of one hundred pounds per square foot of floor surface, when the uses to which such building, or part thereof, is to be applied, involve greater stress. The calculations and loads shall be in accordance with the provisions of this chapter. In every building of Class I now constructed and in use, whenever it shall be found by the Commissioner of Buildings that the floors of same, or any part or parts thereof, are not capable of bearing, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be upon the same, a live load of forty pounds for every square foot of surface, he shall condemn the same and order such floor or floors to be repaired or reconstructed within a reasonable time by the owner or occupant thereof, and shall proceed in the manner prescribed in sections 201 and 202 of The Chicago Code of 1911, and in such case it shall be unlawful for the owner or occupant to continue to use such building until the said floors shall be repaired or reconstructed in accordance herewith.

*Amended November 13, 1911.

***253. Elevator Buildings.)** Elevator buildings intended solely for the receipt, storage and delivery of grain in bulk, shall be of fireproof construction as described in this chapter.

ARTICLE V.

Class II.

***254. Class II Defined.)** (a) In Class II shall be included every building referred to in subdivisions Class IIa, Class IIb and Class IIc.

(b) In Class IIa shall be included every building used for office purposes, and also every building used for clubhouse purposes where sleeping accommodations are provided for less than twenty persons.

(c) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(d) In Class IIc shall be included every building used for a hospital, home for the aged and decrepit, for housing the sick and infirm, imbeciles or children, house of correction or detention, jail or asylum, where any such building shall have sleeping accommodations for more than ten persons.

*Amended May 8, 1916.

***254½. Must Comply With General and Special Provisions.)** Every building of Class II shall comply with the general provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

255. Allowance for Live Loads in Construction of Floors of Class II.) For all buildings of Class II the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of fifty pounds for every square foot of surface, and such live load shall be

computed in accordance with the provisions of this chapter.

236. Windows and Mechanical Ventilation.) (a) In every building hereafter erected for or converted to the purposes of this class, courts shall be of the minimum widths and areas prescribed in Section 442 of this chapter, and vent shafts as defined in Section 432 of this chapter, shall be of the following minimum width and areas:

Height of Shaft.	Least Width in Feet.	Square Feet.
1 story	3	21
2 stories	3	22½
3 stories	3	27
4 stories	3	36
5 stories	5	48
6 stories	6	72
7 stories	8	96
8 or more stories	8	120

(b) In every building hereafter erected for or converted to the purposes of this class, every room used as a private sitting room or as a sleeping room, shall have at least one window which opens directly upon a street, alley, yard or court. The total glass area of such window or windows opening directly upon a street, alley, yard or court shall be not less than one-tenth of the floor area of such room. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened. No such window shall have a glass area of less than ten square feet unless it be a window in excess of the one-tenth of the floor area as required by this paragraph. Provided that sleeping cells in prisons, jails, police stations and houses of detention need not have each a window opening directly on a street, alley, yard or court if such cells are in a cell block which has windows with a glass area equal to one-fourth of the floor area of such block and arranged so that each window may be opened for one-half of its area, and provided further that such cell block and cells shall be equipped with a system of mechanical ventilation approved by the Commissioner of Health.

(c) In every building hereafter erected for or converted to the purposes of this class, every pantry, bath room and water closet and urinal compartment shall have at least one window which opens directly upon a street, alley, yard, court or vent shaft; the total glass area of such window or windows opening directly upon a street, alley, yard, court or vent shaft shall be not less than one-tenth of the floor area of such room or compartment. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened; and no such window shall have a glass area of less than six square feet or a glass width of less than one foot; provided, however, that such room or compartment, if located in the upper story of any such building, may be lighted and ventilated by means of a skylight having a glass area equal to one-tenth of the floor area of the room it serves and be equipped with an efficient ventilator or ventilators equal in effective area to one-twentieth of the floor area of such room; and provided further, that any such room or compartment in a building used for office, club or hotel purposes, in lieu of such window or windows, may be ventilated by an approved mechanical ventilation system which shall effect at least six complete changes of air per hour.

(d) In every building hereafter erected for or converted to office, hotel or club purposes, every room, except a room used as a bakery, which is below street grade and which is frequented by the public or in which there are regularly employed five or more persons, shall be ventilated by an ap-

proved mechanical ventilating system which shall effect at least six complete changes of air per hour; provided that in case of store rooms below street grade having 1,500 cubic feet of space per person employed therein two changes of air per hour will be deemed sufficient. In buildings of this class every room, either above or below grade, used as a bakery, shall comply with the provisions of the ordinances of the City of Chicago in respect to bakeries.

(e) In every building hereafter erected for or converted to the purposes of this class, every room not otherwise specifically provided for in this section shall, where practicable, have a window or windows, with a total glass area not less than one-tenth of the floor area of such room, opening directly onto a street, alley, yard or court, and no such window shall have a width of less than one foot or a total glass area of less than ten square feet, unless such window is in excess of the ten per cent of floor area requirement; provided that, if it be impracticable to ventilate any such room by windows as aforesaid, such rooms shall be ventilated by an approved mechanical ventilating system which shall effect at least six complete changes of air per hour; the air supply being taken from the outer air at a point not less than ten feet above the street level.

(f) It shall be the duty of the owner, agent, architect, or party in possession or control of any building in which a mechanical system of ventilation shall have been installed under the requirements of this section, upon completion of such system, to notify the Commissioner of Health in writing at least twenty-four hours in advance of the making of a test of such system; and each such system or unit shall be tested for volumetric efficiency by the owner or his representative in the presence of the representative of the Commissioner of Health and such system shall not be considered as meeting the requirements of this section until it shall have been approved by the Commissioner of Health. Every such mechanical ventilating system shall at all times be kept in good repair and in operation so as to insure the required ventilation of all rooms and compartments planned to be ventilated thereby, during all hours of human occupancy.

Class IIa.

257. Class IIa Defined.) In Class IIa shall be included every building used for office purposes, and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

258. Buildings—Construction of—Height of.) (a) Buildings of Class IIa which are ninety feet or more in height shall be built entirely of fireproof construction.

(b) Buildings of Class IIa less than ninety feet and more than fifty feet in height shall be built either of slow-burning mill or fireproof construction.

(c) Buildings of Class IIa not exceeding fifty feet in height may be built of ordinary construction.

Class IIb.

259. Class IIb Defined.) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

260. Buildings—Construction of—Height of.) (a) Buildings of Class IIb more than five stories and basement high shall be of fireproof construction.

(b) Buildings of Class IIb more than three stories and basement high but not more than five stories and basement high

shall be of slow-burning or fireproof construction. In case slow-burning construction be required the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

261. Walls—Divisions and Partitions—Fire Stops.) (a) In buildings hereafter erected used wholly, or in part for the purposes of Class IIb of ordinary, slow-burning or mill construction, there shall be for every eight rooms in any one story, dividing walls or partitions of incombustible material separating such eight rooms from the contiguous spaces.

(b) In all buildings hereafter erected to be used wholly or in part for the purposes of Class IIb, all elevators and stairs shall be enclosed in partitions of incombustible or fireproof material, and the partitions of all corridors leading to such elevators and stairs shall be of fireproof or incombustible material. Such partitions shall be carried on self-supporting masonry or a framework of steel or iron. Where glass is used in said partitions, the same shall be wired glass set in metal frames but such glass shall not exceed sixty per centum of the superficial area of said partitions.

(c) In all non-fireproof buildings of Class IIb there shall be between joists a stop of brick, concrete or tile not less than four inches in thickness, extending the full height of joists and spaced not more than twenty-five feet apart, measured in the direction of the length of the joist.

262. Sleeping Stalls in Rooms—When Allowed.) Sleeping stalls shall not be constructed or used in any room in any building now existing or hereafter erected and devoted, in whole or in part, to the purposes of a lodging or rooming house unless such room has two or more windows which open directly upon a street, alley, yard or court and which windows have a total area equal to at least one-tenth of the floor area of such room, nor unless the semi-partitions forming such stalls are so constructed that there is a clear and unobstructed interval of at least thirty inches between the top of such semi-partitions and the ceiling of the room, nor unless each such stall shall open directly into an aisle or passageway leading directly to a stairway or stairway fire escape, the location of which is indicated by a red sign and at night by a red light also. Such sleeping stalls shall not be installed in any such room in such numbers that there shall be less than 400 cubic feet of air per person when all stalls are occupied to their full capacity. The semi-partitions forming such stalls hereafter constructed shall be of incombustible material.

Class IIc.

***263. Class IIc Defined.)** In Class IIc shall be included every building used for a hospital, home for the aged and decrepit, for housing the sick and infirm, imbeciles or children, house of correction or detention, jail or asylum, where any such building shall have sleeping accommodations for more than ten persons.

*Amended May 8, 1916.

***264. Buildings—Construction of—Height of.)** (a) All buildings of Class IIc not more than two stories and basement in height may be of ordinary, mill or slow-burning construction.

*Amended May 15, 1911.

(b) All buildings of Class IIc more than two stories and basement in height shall be of fireproof construction.

*Both paragraphs (a) and (b) amended May 8, 1916.

265. Frontage Consents for Hospitals.) It shall be unlawful for any person, firm or corporation to build, construct, maintain,

conduct or manage in any block in which two-thirds of the buildings fronting on both sides of the street or streets on which the proposed hospital may front are devoted to exclusive residence purposes, any hospital unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building faces consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in said block. Such written consents of the majority of said property owners shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing, or a license be issued for the maintaining, conducting or managing of any such hospital.

266. Coves in Rooms and Corridors of Hospitals.) In every building hereafter constructed for or converted to hospital purposes, in all corridors and rooms used by patients, all intersections of walls, floors and ceilings shall be formed with tangent coves.

267. Elevators in Hospitals.) Every building over three stories in height hereafter constructed for or converted to hospital purposes shall have at least one elevator, the floor dimensions of which shall be not less than seven feet by five feet, and said elevator shall be enclosed in a fireproof shaft with incombustible doors closing off each opening and shall comply with all the general provisions of this chapter.

268. Fire Escapes, Balconies, Platforms.) All buildings of Class IIc shall be equipped with stairway fire escapes not less than three feet in width which shall, in number, location and structural features, comply with the general provisions of this chapter relating to fire escapes. The balconies and platforms of such fire escapes shall be not less than three feet in width and may be made with a smooth surface of incombustible material laid flush with the floor and with a pitch of one-third inch to the foot.

269. Standpipes and Portable Hand Pumps.) (a) On each floor of every building used for the purposes of Class IIc there shall be provided, for each two thousand square feet of floor area or fractional part thereof, at least one portable hand pump of three gallon capacity or one chemical extinguisher of equal capacity, which shall be located and maintained subject to the approval of the Fire Marshal.

(b) In every building more than three stories in height hereafter erected for or converted to the purposes of Class IIc there shall be constructed one or more four-inch stand pipes which shall extend from the basement to the roof and which shall be connected with the house pump and house tank and which shall have a Siamese connection located on the street or alley side of such building for the use of the first department. Each stand pipe shall be provided with one hose connection with fire department thread on the roof of said building, and one connection on each floor and in the basement thereof, with sufficient hose attached on each floor and in the basement so that a stream of water therefrom will reach any point thereof. The pattern, quality, installation and maintenance of such stand pipes, hose and connections shall be subject to the approval of the Fire Marshal.

ARTICLE VI.

Class III.

270. Class III Defined.) (a) In Class III shall be included every building used as a family residence, and also every building used for garage or stabling purposes and having a ground area of less than 500 square feet.

270½. Must Comply With General and Special Provisions.) Every building of Class III shall comply with the provisions of this chapter, and, in addition to the general provisions, shall comply with the following special provisions:

***271. Buildings—Construction of—Height of—Space Occupied on Lot.)** (a) Every building of Class III which is ninety feet or more in height shall be built entirely of fireproof construction.

(b) Every building of Class III less than ninety feet and more than fifty feet in height shall be built entirely of slow-burning, mill or fireproof construction.

(c) Every building of Class III less than fifty feet in height may be built of ordinary construction.

(d) The amount of space occupied on any lot by Class III buildings shall comply with the requirements of Section 440 of this chapter.

(e) *Buildings used for garage purposes only, having a ground area of four hundred (400) square feet or less, may be built with enclosing walls and roof of corrugated iron or galvanized sheet steel supported on a frame of steel construction.*

**Paragraph (e) added December 18, 1911.*

272. Skylights — Construction of — Glass in.) (a) The skylight on the roof of every building of Class III erected within the fire limits shall have its sides, sashes and frames constructed of metal or of metal-clad wood on all exterior surfaces.

(b) Such skylights shall be covered by a strong wire netting with mesh not more than one and one-half inches square placed not less than six inches above the glass, supported on uprights of incombustible material, unless wired glass is used.

273. Allowance of Live Loads in Construction of Floors.) In every building of Class III, the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of 40 pounds for every square foot of surface.

***274. Habitable Rooms—Definition of—Requirements as to Size and Ventilation.)**

(a) For the purposes of this chapter the term "habitable room" shall be held to include every room in every building of Classes III and VI, and every room in buildings of other classes if such rooms are used for the purposes of Classes III and VI, in which a family or the individual members thereof regularly sleep or eat or carry on their usual domestic or social vocations or avocations. Laundries, bath rooms, water closet compartments, serving and storage pantries, storage rooms and closets, boiler and machinery rooms, cellars, corridors, and similar spaces used neither frequently nor during extended periods, shall not be deemed as coming within the scope of this term.

(b) *In every building hereafter erected for or converted to the purposes of Class III, every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area, opening onto a street, alley, or yard, as defined in Section 432 of this chapter; provided, that there shall be a space of at least three feet between the building and the lot line on one side, and a space of at least one foot between the building and the lot line on the other side. None of such required windows shall have a glass area of less than ten square feet; and each such window shall have its top not less than seven feet above the floor and shall be so constructed that at least its upper half may be opened its full width. No such habitable room shall have a floor area of less than eighty square feet, nor a clear height from floor to ceiling of*

less than eight feet and six inches; provided that attic rooms need not be eight feet six inches high for more than one-half of their area, and that such attic rooms shall have total cubic contents of not less than seven hundred and fifty cubic feet each.

**Amended February 20, 1911.*

(c) No living room shall be partitioned off or constructed in any existing building or portion thereof, until plans of such building and room have been filed with, and a permit for such partitioning or constructing obtained from the Commissioner of Buildings and the Commissioner of Health; and every room so partitioned off or constructed shall comply with all the requirements for habitable rooms as contained in this section.

275. Alcoves.) Every alcove and alcove room shall comply with the requirements of Section 446 of this chapter.

276. Pantries, Bath Rooms, Water Closet and Urinal Compartments—Requirements in Relation Thereto.) In every building hereafter erected for or converted to the purposes of Class III, every pantry, bath room, water closet or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of at least one foot opening upon a street, alley, or yard as defined in Section 432 of this chapter, or upon a vent shaft not less in area than said window; and no habitable room shall open into or connect with a vent shaft thus used.

277. Bay Windows and Light Shafts—Materials For.) Bay or oriel windows may be built of combustible material on front or rear elevations of buildings of Class III of two stories or less in height, within the fire limits, provided such bay and oriel windows shall not have a greater width than twelve feet at the wall line of the building, and, provided, that the outside walls, roofs and soffits of such bay or oriel windows, when so constructed, shall be covered with sheet metal or other incombustible material. Light shafts wholly within the walls of a two-story building of Class III may be built of combustible material covered with sheet metal or other incombustible material. In all other cases, bay and oriel windows and light shafts and their supports shall be constructed entirely of incombustible material.

278. Walls—Brick Walls Upon Wooden Sills—Level of Sills Allowed.) Every building of Class III not exceeding one story or twenty feet in height from top of sills to the highest point of the roof, and with the side walls not exceeding fourteen feet in height, and with floor area not exceeding twelve hundred square feet, may have brick walls not less than eight inches in thickness erected upon wooden sills, the sills supported on iron, masonry, or concrete supports extending four feet below the surface of the ground, provided that the portion of the supports above the ground may consist of cypress or cedar posts. The foundations under such supports shall be of concrete, stone or brick, each covering not less than five square feet area and not more than eight feet apart, to support with safety the weight that may rest upon them; sills shall be placed not higher than four feet above the established grade of the street upon which the lot fronts and upon which lot the building is erected, where grades are established, and not exceeding seven feet above the ground where grades are not established. Every building more than one story and less than two stories high, having a gable or hip roof with a rise of not more than thirty degrees, may have eight-inch walls of solid brick or stone masonry, provided the side walls do not exceed fourteen feet in height measured from the first floor joist

and provided such building has a floor area not exceeding 1,200 feet and is not over 22 feet in width.

***279. Stairways in Buildings of Class III Hereafter Erected Three Stories or More in Height.)** (a) In every building of Class III hereafter erected, and three stories or more in height, there shall be either two stairways from the first to the top story or one such stairway and a stairway fire escape.

(b) In every building of Class III now in existence, and three stories or more in height with a floor area of 1,000 square feet above the second floor, which is not equipped with two stairways or with one stairway and a stairway fire escape, safe and adequate means of egress from all floors shall be provided by the erection of additional stairways or stairway fire escapes, or such other means as in the judgment of the Commissioner of Buildings are required for the safety of the occupants of such building or the public.

*Amended June 30, 1916.

ARTICLE VII.

Class IV.

(NOTE: See end of ordinance, page 189, for special ordinance on regulations for operating places of amusement.)

280. Class IV Defined.) (a) In Class IV shall be included every building referred to in subdivisions Class IVa, Class IVb, Class IVc and Class IVd, as follows:

(b) In Class IVa shall be included every building used as a church or place of worship.

(c) In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(d) Class IVc shall include every building hereafter erected used for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred; provided, that every building of Class IVc existing at the time of the passage of this ordinance shall comply with the provisions of Class IVb.

(e) In Class IVd shall be included every grandstand and every baseball, athletic and amusement park.

281. Must Comply with General and Special Provisions.) Every building or structure of Class IV shall comply with the general provisions of this chapter and shall, in addition, comply with the following special provisions:

282. Must Comply With All Ordinances.) It shall be unlawful for any person, firm or corporation to construct or alter any theatre except in conformity with the ordinances of the City of Chicago relative thereto, or to operate any theatre that does not conform thereto.

283. City Officials Empowered to Enter.) The Commissioner of Buildings, Commissioner of Health, City Electrician, Fire Marshal, Superintendent of Police, and their respective assistants, shall have the right to enter any building used in whole or in part for the purposes of Class IV at any reasonable time, and at any time when occupied by the public, in order to examine such building, and it shall be unlawful for any

person to interfere with them in the performance of their duties.

284. City Officials Empowered to Close.) The Commissioner of Buildings, Commissioner of Health, Fire Marshal, City Electrician, or Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class IV, to be closed, where it is discovered that there is any violation of any of the provisions of this chapter, and kept closed until the same are complied with.

285. Theaters in Frame Buildings Prohibited.) On and after June 1, 1911, no frame building or part thereof shall be used as a moving picture, vaudeville or other theatre.

286. Buildings—Height—Construction—When Used in Part as Class IV.) Every building higher than sixty feet, used in whole or in part for the purposes of Class IV or connected with or made part of any building so used, shall be entirely of fireproof construction. Every such building less than sixty feet in height shall be made of fireproof, slow-burning or mill construction, except as provided in this chapter.

CLASS IVA

287. Class IVa Defined.) In Class IVa shall be included every building used as a church or place of worship.

288. Frontage—Seating Less than Eight Hundred.) Every building of Class IVa hereafter erected containing an aggregate capacity of 800 persons or less, shall have for the auditorium a frontage upon two open spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

***289. Frontage—Seating Over Eight Hundred.)** Every building of Class IVa hereafter erected containing an aggregate seating capacity greater than eight hundred persons, shall have a frontage upon three open spaces of which at least one shall be a public street and the others, if not streets, shall be public or private alleys of a width of not less than ten feet each, opening directly on a public street or alley, with at least one exit into each open space.

*Amended June 12, 1916.

290. Construction of.) (a) Every building of Class IVa, which has a seating capacity of less than 600 may be built of ordinary construction. Every building Class IVa having a seating capacity of more than 600 and less than 1,800 shall be built of slow-burning, mill or fireproof construction.

(b) Every building of Class IVa having an aggregate seating capacity greater than 1,800 persons shall be built of fireproof construction.

291. Limitations of Floor Level in Class IVa—Height Above Sidewalk.) (a) The limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVa, shall be as follows:

(b) No auditorium of a greater seating capacity than 1,000, shall have the highest part of its main floor at a greater distance than 10 feet above the adjacent sidewalk grade. No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVa having a greater seating capacity than two hundred shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used

either wholly or in part for the purposes of Class IVa, and built of fireproof construction, a room or rooms to be used for the purposes of Class IVa and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than 4 feet wide in the clear and shall be equipped with emergency exits and not less than one stairway fire escape.

292. Allowance for Live Loads in Construction of Floors of Buildings of Class IVa—Stairways—Entrances and Exits, Width of.) Every floor in buildings of Class IVa shall be designed and constructed in such a manner as to be capable of bearing in all its parts, in addition to the weight of floor construction, partitions, and permanent fixtures that may be set upon same, a live load of 100 pounds for every square foot of surface on such floor. The width of stairways in buildings of this class shall be twenty inches for every one hundred of the aggregate seating capacity, and for fractional parts of one hundred seating capacity, a proportionate part of twenty inches shall be added to the width of such stairway, but no stairway in such building shall be less than four feet wide in the clear, except as hereinafter provided, and provided further, that in any such building having a gallery, the seating capacity of which does not exceed two hundred and fifty persons, two separate and distinct stairways, each not less than three feet wide, shall be permitted.

293. Galleries—Exit and Entrance.) Distinct and separate exits shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the gallery or galleries, provided its capacity be equal to the aggregate capacity of all aisles or corridors leading from the main floor and such gallery or galleries to such place of exit or entrance. Not more than two galleries, placed one above the other, shall be permitted in any building of (Class IVa).

***294. Stairways—Aisles—Steps in Aisles—Passageways, Kept Unobstructed.)** (a) Aisles in buildings of Class IVa shall, in the aggregate, be eighteen inches in width for each 100 of the seating capacity of the auditorium, and for fractional parts of 100, a proportionate part of 18 inches shall be added, but no aisle shall be less than two feet six inches in width in its narrowest part. Steps shall be permitted in aisles only as extended from bank to bank, of seats, and wherever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made on an inclined plane; and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors. All aisles and passageways shall be kept free from all portable furniture and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles or passageways during the services.

*Paragraph (b) struck out February 20, 1911.

295. Corridors, Passageways, Hallways and Doors—Width of.) The width of corridors, passageways, hallways and doors, adjacent to, connected with, or a part of the auditorium, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such

doorway shall be less than three feet in width.

296. Seats, Number of, in Rows.) There shall not be more than fourteen seats in any one row between aisles. Rows of seats shall not be less than two feet eight inches from back to back, and no bank of seats shall be of greater rise than twenty inches.

297. Emergency Exits—All Doors to Open Outward.) (a) Emergency exits and outside stairways shall be provided for every building of Class IVa, which has a larger seating capacity than 800. Such emergency exits shall be one-half the aggregate width of the main exits, but no such emergency exits shall be less than three feet in width. Provided, that such stairways may be built inside the walls of the building in a corridor or passageway not less than seven feet wide and enclosed by a fireproof partition not less than four inches thick. Such stairway shall be of fireproof construction. All emergency exits and stairways therefrom shall be kept free from obstructions of any kind including snow and ice.

(b) All doors affording egress, directly or indirectly from the auditorium to a street or alley, shall open outward. Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the time that the building is occupied, and shall be so constructed and maintained that they may be easily opened from within.

298. Buildings in Which Seats are Not Fixed—Seating Capacity.) In computing the seating capacity of any room or building used for the purposes of this class in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided, that in buildings of Class IVa standing at least seven feet from any other building and not having more than two stories and each floor having its own separate exits, the seating capacity of such floor shall be estimated alone as determining the kind of construction under this article.

299. Every Portion to Be Lighted When Occupied at Night—Flues.) Every portion of a building of Class IVa and all outlets therefrom leading to streets or spaces connected therewith, including the vestibules, halls, corridors, passageways, and stairway, exits, shall be properly lighted whenever occupied between sunset and sunrise, and the same shall be kept so lighted until the entire audience have left the premises; and every passageway, corridor, stairway and exit shall be provided with a sign indicating the way out of the building, the letters of which shall not be less than six inches in height. All lights indicating exits in vestibules, halls, passageways, corridors or other means of egress from the building shall be controlled by a separate shut-off, located near the main entrance, and controlled only in that particular place. A red light furnished by gas or sperm oil shall be kept burning, in connection with the word "Exit" over every such opening, during the entire time such building is occupied between sunset and sunrise. Flues used to carry off heat from open lights shall be of incombustible material, and shall have at least twelve inches clearance from any combustible material.

Class IVb.

300. Class IVb Defined.) In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose

of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

301. Frontage—Seating Less Than Eight Hundred—Seating More Than Eight Hundred. (a) Every building of Class IVb, containing a hall or halls of an aggregate seating capacity of 800 persons or less, shall have a frontage upon two public spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

(b) Buildings of Class IVb, containing halls or rooms, used for the purpose of Class IVb, of greater aggregate seating capacity than 800, shall have a frontage upon three open spaces, of which at least one shall be a public street, while the other two, if not streets, shall be public or private alleys, of a width of not less than ten feet, each opening directly on a public street or alley; provided that a fireproof passageway at grade level, and not less than seven feet in width may be used in place of one such alley, if such passageway connects with a public thoroughfare.

302. Auxiliary Buildings—Height and Construction of—Communicating Doors.

(a) Every building hereafter erected and connected with or made part of any building used in whole or in part for the purposes of Class IVb, shall, if sixty or less feet in height, be of fireproof, mill or slow-burning construction, except as otherwise provided in this chapter, and, if more than sixty feet in height, of fireproof construction.

(b) No existing building, other than of fireproof construction, shall be connected to any building of Class IVb now existing or hereafter constructed, unless there is, between such buildings, a fire wall constructed as required by Section 519 of this chapter and extending from the ground to and through the roof.

(c) In all such cases where both buildings are not of fireproof construction, each opening in the intervening walls shall be equipped with automatic double fire-doors as required by Section 573 of this chapter.

303. Existing Buildings—Used for Class IVb and for Other Purposes. (a) No part of an existing building, other than of fireproof construction shall be used for the purposes of Class IVb unless such part is separated from all portions of the same building used for other purposes by a fire wall constructed as required by Section 519 of this chapter and extending from the ground to the roof and unless all openings in such fire wall are equipped with automatic double fire doors as required by Section 573 of this chapter; in which case such other portions may be constructed in the manner permitted for separate buildings of such class.

304. Construction—Depending on Capacity. (a) Every building used for the purposes of Class IVb, hereafter erected, containing a hall or room of an aggregate seating capacity of not more than 1,500 persons, shall be built of mill, slow-burning or fireproof construction. Every building hereafter erected used for theatrical purposes, with a seating capacity greater than three hundred shall be built to conform to the requirements of buildings of Class V hereafter erected. If a hall or room or halls or rooms have a total seating capacity of more than 1,500 persons, such building shall be built of fireproof construction; provided, that buildings mainly used for exposition or exhibition purposes, and not used for theatrical purposes, and not exceeding two

stories in height which have for public use only a main floor and one gallery and which have their walls and structural members of incombustible material and which comply with the provisions of this ordinance as to stairways, exits and fire escapes, may have their temporary seats, boxes, show cases, platforms, or booths, constructed of combustible material; provided, however, that any and all draperies, buntings, or other inflammable decorations shall be treated with a fire-retarding solution, subject to the approval of the Fire Marshal.

305. Buildings in Which Seats Are Not Fixed—Seating Capacity. (a) In computing the seating capacity of any room or building used for the purposes of this Class, in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided, that in buildings of Class IVb standing at least seven feet from any other building and not having more than two stories and each floor having its own separate exits, the seating capacity of each floor shall be estimated alone as determining the kind of construction under this article.

***306. Limitations of Floor Levels—Height Above Sidewalks.** (a) The following limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVb, *other than skating rinks*, shall be as follows: No auditorium of a greater seating capacity than one thousand shall have the highest part of its main floor at a greater distance than ten feet above the adjacent sidewalk grade.

No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVb having a greater seating capacity than two hundred shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used either wholly or in part for the purposes of Class IVb, and built of fireproof construction, a room or rooms to be used for the purposes of Class IVb and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than four feet wide in the clear and such floor or floors shall be equipped with emergency exits and have not less than one stairway fire escape.

(b) In buildings of fireproof construction hereafter erected, banquet halls or ball rooms having a seating capacity of not more than 900 may be located on any floor. Such banquet halls or ball rooms shall have access to at least two interior stairways and not less than one stairway fire escape, the combined width of which shall be equal to at least 18 inches for each one hundred persons for whom accommodations are provided in said banquet hall or ball room.

(c) No room or hall used for the purpose of a skating rink shall be constructed, operated or maintained with its main floor level more than two feet above the inside sidewalk grade of the street upon which the building containing same fronts or more than one foot above the ground or sidewalk level in front of such building when it does not face on a street.

*Amended July 22, 1912.

307. Allowance for Loads in Construction of Floors. (a) All floors of all buildings of Class IVb shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may

be set upon the same, a live load of one hundred pounds for every square foot of surface in such floor, in accordance with the general provisions of this chapter.

***308. Stairways—Entrances and Exits—Width of.)** The width of stairways in buildings used wholly or in part for the purposes of Class IVb, shall be 18 inches for every 100 persons of the aggregate seating capacity of all rooms used for the purposes of Class IVb in such buildings; but no stairway in such building shall be less than four feet wide in the clear; provided, that in any such building having a room or rooms, balcony or gallery, used for the purposes of Class IVb, the aggregate seating capacity of which does not exceed 250 persons, two separate and distinct stairways, each three feet wide, shall be permitted, but no such building hereafter erected shall have less than two interior stairways of the width required by this ordinance, and located as far apart as practicable. Every hall or room used for the purposes of Class IVb in a building hereafter erected, * * * shall have access to not less than two stairways. Every stairway shall have handrails on each side thereof; stairways which are over seven feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high; no stairway shall ascend a greater height than 13 feet 6 inches without a level landing, which landing shall be not less than four feet wide measured in the direction of the run of the stairs. Every stairway leading to a box or boxes shall be independent of all other stairs or seats; and such stairway shall not be less than 2 feet 6 inches wide in the clear when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

*Amended July 22, 1912 ("or converted" struck out).

309. Balconies and Galleries—Designation of.) Where there are balconies or galleries, the first balcony or gallery shall be designated "balcony" and the second and third balconies or galleries shall be designated respectively "gallery" and "second gallery."

310. Balconies and Galleries—Exit and Entrance.) Distinct and separate places of exit and entrance shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the balcony, provided its capacity be equal to the aggregate required capacity of all aisles or corridors leading from the main floor and such balcony to such place of exit and entrance.

311. Aisles—Steps in Aisles—Passageways—Kept Unobstructed—Width of Corridors, Passageways, Hallways and Doors.) (a) Aisles in rooms used for the purposes of Class IVb shall have in the aggregate a width of 18 inches for each 100 of the seating capacity of such room, and for fractional parts of 100 a proportionate part of 18 inches shall be added; but no aisle shall be less than two feet six inches in width

(b) Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than five inches the floor of the aisles shall be made as an inclined plane, and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors. All aisles and passageways in such rooms shall be kept free from campstools, sofas, chairs and other obstructions, and no persons shall be allowed to stand

in or occupy any of such aisles or passageways during any performance, service, exhibition, lecture, concert, ball, or any public assembly.

(c) Where there are emergency exits located at the sides of such rooms, there shall be a cross aisle giving access to such exits. The location of emergency exits and cross aisles shall be subject to the approval of the Commissioner of Buildings.

312. Corridors, Passageways, Hallways and Doors—Width of.) The width of corridors, passageways, hallways and doors adjacent to, connected with or a part of such rooms, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such door shall be less than three feet in width.

313. Seats—Number in Rows.) There shall be not more than fourteen seats in any one row between aisles, and in a room or rooms used for the purposes of Class IVb, of a seating capacity greater than 400 persons, there shall be an aisle on each side of any bank of seats, where there are over seven seats in a row. Rows of seats shall not be less than thirty-two inches from back to back and no bank of seats shall be of a greater rise than twenty inches.

314. Emergency Exits.) (a) Emergency exits and stairways shall be provided outside of any and all rooms used for the purposes of Class IVb which have a seating capacity larger than eight hundred, and such emergency exits shall have a width equal to one-half of the width provided for the main exits and such emergency exits shall lead directly to a public thoroughfare. Provided, however, that any room or rooms used for the purposes of Class IVb in any building hereafter erected, having a seating capacity of more than 400, shall have emergency exits outside of the walls of such building equal in width to one-half of the exits required for the main exits, and such emergency exits shall lead directly to a public thoroughfare. Doors leading to emergency exits shall not be less than three feet wide. Stairs shall be not less than four feet wide. Such emergency exits and stairways may be built inside the walls of such building of a width not less than four feet, provided that they are enclosed by a fireproof partition not less than 4 inches thick; and further provided, that the stairs themselves are constructed of incombustible material. Emergency stairways may descend into open spaces or passageways, provided they do not obstruct more than one-half of the width of such open spaces or passageways.

(b) Every stairway fire escape shall be located and constructed in accordance with the requirements of Sections 669, 670 and 673, but in no case shall any room used for the purposes of Class IVb located above the third story of any building have less than one stairway fire escape.

315. Doors to Open Outward—Draperies.) (a) All doors affording access directly or indirectly to the street, alley or corridor from any room used for the purposes of Class IVb shall open outward.

(b) It shall be unlawful for any person, firm or corporation to obscure the exit doors of any room of a building of Class IVb as defined in this chapter, by draperies, and during the time any such room or rooms are open to the public, said doors shall not be locked or fastened in any manner so as to prevent them from being easily opened outwardly; and such doors shall be constructed and maintained so as to require no special knowledge or effort to open them from the interior.

316. Walls Between Auditorium and Stage.) There shall be a solid brick wall of the same thickness as required for outside walls between the auditorium and stage in buildings hereafter erected for or converted to the use of Class IVb and used either wholly or in part for that purpose; and in existing non-fireproof buildings such wall must extend to a height of three (3) feet above the roof. Provided, however, that in existing buildings any room used for the purposes of Class IVb at the date of the passage of this ordinance having a greater seating capacity than four hundred (400) shall have a proscenium wall built of masonry or incombustible material.

317. Curtain Shall Be of Iron, Steel or Asbestos—Inspection of—Fee.) The main curtain opening in any such room shall have a wrought iron or steel or three-ply asbestos curtain with a wire mesh imbedded therein, which shall be inspected by the Building Department semi-annually, for which inspection a charge of five dollars shall be made, and all other openings in the proscenium wall shall have self-closing iron doors.

318. Structures Over Ceiling—Construction.) If any structure intended to be occupied by people is built over the ceiling of any room, used wholly or in part for the purposes of Class IVb, the girders or trusses supporting the same shall be of steel protected with fireproofing as required for interior columns in Section 625.

319. Standpipe and Hose on Stage.) In every room used for the purpose of Class IVb and having a seating capacity of 250 or more, and where scenery is used a standpipe not less than one and one-half inches in diameter, with a hose connection and hose valve thereon, shall be installed on each side of the stage, and shall at all times have connected thereto and ready for use, a hose of sufficient length to reach any part of the stage. Such standpipes shall be connected with pump or frostproof gravity tank so that a pressure of water of ten pounds per square inch shall be furnished through such standpipe at the highest opening.

320. Vents or Flue Pipes.) (a) One or more vents of flue pipes of metal construction or other incombustible material approved by the Commissioner of Buildings shall be built over the stage, and shall extend not less than ten feet above the highest point of the roof, and shall be equivalent in area to one-twentieth of the area of the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls, and shall be continued and run up on the exterior of the building to a point five feet above the highest point of the additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches, or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

321. Fuse Boxes.) Every fuse box shall be surrounded by two thicknesses of fireproof material with an air space between, and no fuse shall be exposed to the air between the switchboards; all electrical equipment in such rooms shall be installed and maintained to the satisfaction and approval of the City Electrician.

322. Capacity—Certification for License.) (a) The Commissioner of Buildings shall determine the number of persons which every room used for the purposes of Class IVb may accommodate, according to the provisions of this Chapter, and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

(b) No amusement license shall be issued for any room used for the purposes of Class IVb, unless the Commissioner of Buildings, the Fire Marshal and the City Electrician shall first have certified, in writing, that such room complies with the provisions of this Chapter in every respect.

323. Exits—Signs at—Lighting Of.) (a) The word "Exit" shall appear in letters at least six inches high over the openings to every means of egress from every room used for the purposes of Class IVb, and in every such room having a greater seating capacity than 400, a red light furnished by gas or sperm oil shall be provided over such sign.

(b) Every room used for the purposes of Class IVb and all outlets therefrom leading to the streets, including passageways, courts, corridors, stairways, exits, and emergency stairways, shall have gas or electric lighting equipment to properly illuminate such rooms and spaces, and every passageway, court, corridor, stairway, exit, and emergency stairway, shall be provided with signs indicating the way out of the building, the letters of which shall not be less than six inches in height.

324. Lights in Halls, Corridors and Lobbies—Control Of—Separate Shutoff—Connection with Gas Mains—Protection of Suspended and Bracket Lights—Protection of Lights Inserted in Walls—Protection of Foot Lights—Construction of Border Lights—Ducts and Shafts Conducting Heated Air From Lights—Protection of Stage Lights.) Gas and electric lights in the halls, passageways, corridors, lobbies and other means of ingress to or egress from any such room shall be controlled by a separate shutoff, located in an accessible place, subject to the approval of the Commissioner of Buildings, and controlled only by that particular place. No gas or electric light fixture shall be inserted in the walls, woodwork, ceilings or in any part of any such room, unless protected by fireproof materials. The footlights, if gas light, shall be protected by wire network, and also by a strong wire guard, not less than two feet distant from such footlights and a trough containing such footlights shall be formed of and be surrounded by fireproof materials. Border lights shall be constructed according to the best known methods, subject to the approval of the City Electrician, and shall be suspended by wire rope. Ducts and shafts used for collecting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal, and made double with an intervening air space. Stage lights, if gas, shall have strong wire guards or metal screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of flame, and such guards or screens shall be firmly soldered to the fixtures in all cases.

325. Scenery—Definition—Movable Scenery.) (a) "Scenery" as used in this chap-

ter shall include all scenery, drop curtains and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

"Movable scenery" shall include all scenery, drop curtains, borders and wings which are made movable for the purpose of changing scenery and substituting another set during or between the various stage acts.

***326. Scenery to Be Non-Inflammable.)** No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for the purposes of Class IVb, unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

***327. Amount of Scenery Allowed—Sprinkler System.)** Two sets of house scenery and three drops, exclusive of asbestos fire curtain and picture screen shall be allowed in existing rooms used for theatrical purposes in buildings of Class IVb where the same are on the first floor level, or in a building of fireproof construction or which conformed with the requirements of fireproof buildings at the time same was erected, and the same shall also be allowed in such existing rooms used for theatrical purposes above the first floor level when the seating capacity of such room does not exceed 300. Such scenery shall be known and designated upon the licenses issued by the city as "Permanent House Scenery," and the use and moving of such scenery shall not be construed as placing said building, hall, room or theatre within the provisions of the ordinance relating to Class V buildings.

A set of house scenery as contemplated by this section is hereby defined to mean sufficient scenery to make one stage setting, such scenery being in continuous use in such house; provided, however, that the lowering of a drop shall not constitute a new stage setting.

No other scenery except as above enumerated shall be permitted on, above or underneath the stage.

Every existing Class IIb theatre affected by this section shall be equipped with an approved sprinkler system and also with standpipe and hose subject to the approval of the Fire Marshal.

No existing Class IIb theatre affected by this section shall increase its seating capacity after the passage of this ordinance.

No scenery or stage paraphernalia of combustible materials shall be used on the stage of any room or theatre used for the purposes of Class IIb, unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

*Amended July 22, 1912.

328. Dressing Room Partitions.) Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated.

329. Apparatus Under Control of Fire Marshal.) The standpipes, hose, vent flues and all apparatus for the extinguishing of fire or guarding against the same, required by the provisions of this ordinance to be provided shall be at all times so provided and kept in a manner satisfactory to the Fire Marshal.

CLASS IVc.

***330. Class IVc Defined—Moving Picture and Vaudeville Shows—Seating Capacity.)** Class IVc shall include every building hereafter erected used for moving picture or vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hun-

dred, provided that every building of Class IVc existing at the time the passage of the ordinance known as The Chicago Code of 1911 shall comply with the provisions of Class IVb. All buildings hereafter erected for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, with a seating capacity of over three hundred, and for the exhibition of moving pictures only, where the seating capacity is more than one thousand, shall be built to conform with the requirements for buildings of Class V hereafter erected as contained in this chapter. Buildings for the exhibition of moving pictures only and with a seating capacity of over three hundred, but not to exceed one thousand, shall also be built to conform with the requirements for buildings of Class V hereafter erected, in all their structural requirements and equipment except in so far as such requirements and equipment are modified in Sections 331 and 332 hereof.

*Amended June 21, 1912.

***331. Frontage of Class IVc—Frontage, Open Spaces and Fireproof Passageways of Moving Picture Theatres Containing a Seating Capacity of more Than Three Hundred.)** Every room used for the purposes of Class IVc shall have a frontage upon at least two public thoroughfares, of which at least one shall be a street, and the other a street or a public or private alley not less than ten feet wide and opening directly on a public street or alley.

Buildings for the exhibition of moving pictures only, with a seating capacity of over three hundred but not to exceed one thousand, shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten feet in width. Except as hereinafter otherwise provided, the audience room of such building shall have either a public thoroughfare or an open space unobstructed from the ground to the sky on each side thereof. Such open space, when the audience room has a capacity not to exceed six hundred seats, shall be five feet wide, and six inches shall be added to the width of same for every additional one hundred seats in said audience room up to the maximum of one thousand seats. In all cases where there is a public alley in the rear of such building, said open space must connect directly with the alley. In case the entire audience is seated on the ground level said open spaces shall extend alongside of the audience room so as to connect with exit doors placed approximately in the middle of the audience room between the opposite ends of same. Where there is a balcony or gallery in stalled, such open spaces must extend along the entire length of the audience room so as to connect with exits from the balcony or gallery at their highest and lowest levels. Where such a building is located on a corner lot and adjoins a public street on one side and a public street or an alley not less than ten feet wide on two of the remaining sides and the building is so located that it adjoins such public thoroughfares on three sides for its entire extent, it shall not be necessary to construct an open space on the remaining side thereof, but in all such cases there shall be either an open space unobstructed from the ground to the sky or a fireproof passageway at least five feet wide leading from the side of the audience room not bordering on a street or other public space to the street in front of the theatre and another leading to the alley or other public space in the rear of the theatre. If the seating capacity of such theatre is over six hundred, six inches shall be added to the width of such open space or passageway for every one hundred seats or fraction thereof in excess of six hundred and up to the maximum of one thousand. If access to the street and alley or other public space as herein provided is by means of a fireproof passageway, such fireproof passageway must be constructed in all respects according to the provisions of Section 402 of The Chicago Code of 1911, except as herein otherwise provided.

*Amended June 21, 1912.

***332. Construction.)** Buildings of Class IVc hereafter erected, of a seating capacity not to exceed three hundred shall not be built more

than thirty feet in height and may be built of ordinary construction, but the enclosing walls shall be constructed of masonry. No moving picture, vaudeville or theatrical show shall hereafter be installed in a frame building. No room or hall used for the purposes of Class IVc shall hereafter be installed underneath any living or sleeping room.

Buildings for the exhibition of moving pictures only with a seating capacity of more than three hundred but not to exceed one thousand, when the same shall be located as provided for in Section 331 hereof, may be built as herein provided. Said buildings shall contain no stage, proscenium wall nor scenery of any description. The screen for the display of the pictures must be attached to the rear wall of the building, not to exceed six inches away from same. No decorative walls or paintings or other effects shall be constructed inside the audience room in such a manner as to allow any rooms or spaces between same and the enclosing walls of the building. An open platform not to exceed seventy-two square feet in area may be built before the picture screen. On the main floor of such building there shall be at least two main aisles with direct exits at front and rear and two cross aisles with direct exits from the side. When such building contains a balcony or gallery there shall be emergency exits from the highest and lowest levels of same on one side and on the other side there shall be either emergency exits or enclosed interior stairs from the highest level of the balcony, and the lowest level of the balcony shall be connected with such side stairs by means of a tunnel. All seats in the audience room shall be at least twenty inches wide and spaced thirty-four inches from back to back. The booth for the moving picture machine must be of construction in conformity with the requirements for such machine booths in buildings of Class IVc; in all other respects such buildings shall comply both in structural requirements and equipment with the provisions of the ordinances relating to theatres of Class V hereafter erected.

*Amended June 21, 1912.

Provided, however, that where such building has no balcony or gallery and the seats in the audience room are all on the ground floor of same, and where no portion of the building connected with or made a part of or used in conjunction therewith exceeds two stories in height, and where the lobbies and entrances leading to such part of the building used for purposes of Class IVc have brick dividing walls separating them from the portions of the building connected therewith used for the purpose of any other class as defined in this ordinance, and the floors of said lobbies and entrances and the floors and ceilings above such lobbies and entrances are of fireproof construction and there are no doors or windows leading from such lobbies and entrances to any portion of the said building used for any other purpose than Class IVc, such portion of said building as is not used for purposes of Class IVc may be built in accordance with the provisions of the ordinances designating the manner of construction for such classes.

*Amended (by adding proviso to end of section) February 6, 1913.

333. Floor Levels—Limitations.) The following limitations of floor levels shall apply to every building used for the purposes of Class IVc; the highest part of the auditorium floor shall not exceed four feet above the sidewalk level. The floor level at the entrance shall not be at a greater height than eight inches above the sidewalk. The aisles shall not have a greater incline than 1½ inches to the foot.

334. Stairways.) Where external stairways are required, such stairways shall be at least six inches wider than the exits, and shall have treads not less than ten inches wide and risers not more than 9 inches high, and shall be provided with suitable handrails on each side thereof, and the width of such stairs shall comply with the requirements of Class IVb.

335. Balconies and Galleries.) In non-fireproof buildings hereafter erected for, or

converted to the purposes of Class IVc, not more than one balcony and no galleries shall be constructed.

336. Aisles—Steps and Aisles—Passages to be Kept Unobstructed.) Aisles and rooms used for the purposes of Class IVc shall have in the aggregate, a width of not less than 20 inches for each 100 of seating capacity of such room and for fractional parts of 100, a proportionate part of 20 inches shall be added, and no aisle shall have a width of less than two feet six inches. When side emergency exits are permitted, there shall be a cross aisle not less than three feet wide, leading directly to said exit. Steps shall not be permitted in any aisle or in any portion of the auditorium floor. Every aisle, passageway, entrance and exit shall be free from turnstiles, railings or other obstructions.

337. Corridors — Passageways — Doors — Width Of.) The width of corridors, passageways and doors shall be computed in the same manner as provided in Sections 311 and 312.

338. Seats—Size—Location.) There shall not be more than ten seats in any one row between aisles, nor more than six seats between an aisle and side wall. Seats shall not be less than thirty-two inches from back to back and shall not be less than twenty inches in width measured at the top of the seat back, and shall be secured firmly to the floor.

339. Exits.) In every building of Class IVc, there shall be provided at least two entrance doors. No entrance doors shall be less than four feet in width. If the rear of the building abuts upon an alley, there shall be provided not less than two emergency exits leading directly to the said alley. Wherever emergency exits pass over or under the stage floor level, they shall be enclosed with walls of masonry nine inches in thickness, or four-inch hollow tile, or of two-inch solid plaster, composed of iron studs and metal lath and plaster, and shall have floors and ceilings of slow-burning, mill, or fireproof construction. If the side of the auditorium abuts upon a street or alley, such emergency exits shall be located as follows: one exit shall be located at a distance not greater than five feet from the proscenium wall or stage, and the other exit shall be located at a distance half way between the foyer and the stage wall. Exits by means of stairways or stairway fire escapes, equal in width to eighteen inches for each one hundred persons, shall be provided, and for fractional parts of one hundred, proportionate part of eighteen inches shall be added. No such exit shall be less than two feet six inches in width.

340. Doors to Open Outward.) All doors affording ingress or egress in buildings of Class IVc shall open outward, and no door shall be less than three feet wide. Such doors, as well as any entrance or exits or opening, shall not be obscured by curtains or draperies, and no door shall be locked or fastened at any time during the time such building is open to the public, and no door or opening shall be less than three feet wide. Such doors shall be so constructed and maintained that they may easily be opened from within.

341. Walls Between Auditorium and Stage.) Where the area of the stage exceeds 72 square feet, there shall be provided a proscenium wall of solid masonry of not less than nine inches in thickness, extending from ground to the roof. Where the stage area is less than 72 square feet its proscenium wall may be constructed of two-inch solid plaster walls, composed of metal studs and metal lath and plaster or three-inch hollow tile. In no case shall the underside

of ceiling or roof over stage house behind proscenium wall be at a higher level than three feet over the highest point of main proscenium opening. And there shall be no trap doors or other openings in the stage floor.

342. Curtain.) (a) The main curtain in the opening of the proscenium wall shall be composed of long fibre asbestos twisted on brass wire and woven into a close cloth. The laps shall be sewed with two lines of brass and asbestos stitching, which laps shall not be less than one-inch wide. Said cloth shall be lapped at least four times around the top and around the bottom bars with at least three lines of the stitching above specified.

(b) The edge of the curtain shall be continuously reinforced by lapping and stitching and also with pieces of sheet metal for clips. The curtain shall be at least thirty inches wider and higher than the masonry opening, and shall have steel top and bottom bars of not less than two square inches in cross section which bars shall be connected by four three-sixteenth-inch steel cables.

(c) There shall be three-eighth-inch spanning cables with upper ends secured to steel brackets fastened to the wall and the lower ends sufficiently counter-weighted to keep the cables taut and where cables pass through the stage floor, the holes shall be metal bushed.

(d) The curtain shall have hard wood eyelets not over eighteen inches center to center, around the standing cables on both vertical edges, which eyelets shall be secured to the curtain by bent brass clips riveted to the curtain with double sheet metal reinforcing.

(e) There shall be steel lifting cables, one-half inch in diameter, at each end of the curtain and at intermediate points not over ten feet apart attached to drums on shafts located above the curtain.

(f) The operating machinery shall be built according to good mechanical engineering practice.

(g) There shall be emergency chains midway between the lifting cables, to hold the curtain which shall be equal in strength and efficiency to the lifting cables.

(h) There shall be steel guides of not less than three-eighth-inch metal on each side of the curtain from the stage floor to the level of the overhead sheaves. The metal guides shall lap the edges of the curtain not less than four inches. The curtain shall be incombustible in all its parts and its operating devices.

(i) The painting and the manner of tripping the curtain and the number of and the location of places for tripping shall be subject to the approval of the Fire Marshal.

(j) A permit shall be obtained from the Department of Buildings for the erection of each such curtain. The Commissioner of Buildings shall inspect each such curtain semi-annually for which semi-annual inspection, a fee of \$5.00 shall be charged.

343. Other Openings in Stage Walls.) Every other opening in the proscenium wall or in the other walls of the stage shall have self-closing incombustible doors.

344. Structure Over Ceiling—Construction.) A structure may be built over the ceiling or roof of any building used wholly or in part for the purposes of Class IVc, provided such space is not used for sleeping or living purposes. Girders or trusses supporting same shall be of steel protected by fireproofing as required in Section 625 and the entire ceiling shall be covered with incombustible material subject to the approval of the Commissioner of Buildings.

345. Picture Machine Booth.) The walls, floor and ceiling of every moving picture

booth or machine house shall be built of four-inch hollow tile or four-inch solid concrete, supported on iron beams or columns, the door of operating room to be metal clad and swing outwards. There shall be a metal smoke or flue pipe eighteen inches in diameter extending from ceiling to three feet above roof of machine house and terminating in the open air.

346. Standpipes and Hose on Stage.) When the stage area exceeds seventy-two square feet and combustible scenery is used on stage, there shall be a water stand-pipe not less than 1½ inches in diameter with hose connections and hose of sufficient length to reach any and all portions of stage. Said stand-pipe shall be connected to either a fifteen-hundred-gallon frost-proof gravity tank located twenty-five feet above stage level, or to a two-inch city pipe connection, satisfactory to the Fire Marshal.

347. Vent or Flue Pipe Over Stage.) (a) When the stage exceeds seventy-two square feet in area and combustible scenery is used, one or more flue pipes of incombustible material and equivalent to one-twentieth of the area of the stage shall be built over the stage and shall extend eight feet above the highest point of roof.

(b) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

348. Fuse Boxes.) Every fuse box shall be surrounded by two thicknesses of fire-proof material with an air space between, and no fuse shall be exposed to the air between the switch boards; all electrical equipment in such rooms shall be installed and maintained to the satisfaction and approval of the City Electrician.

349. Capacity—Certification for License.) The Commissioner of Buildings shall determine the number of persons which every room used for the purposes of Class IVc may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

350. Exits, Signs and Lights.) (a) The word "Exit" shall appear in letters six inches high over the openings to every means of egress from such room, and a gas or sperm oil light with red globe shall be provided at or over such exit sign.

(b) Every room used for the purposes of Class IVc and all outlets therefrom leading to the streets, including passageways, courts, corridors, stairways, exits, and emergency stairways, shall have gas or electric lighting equipment to properly illuminate such room and spaces, and every passageway, court, corridor, stairway, exit and emergency stairway, shall be provided with signs indicating the way out of the building, the letters of which, shall not be less than six inches in height.

351. Lights in Halls, Corridors and Lobbies—Control of—Separate Shutoff—Connection with Gas Mains—Protection of Sus-

pended and Bracket Lights—Protection of Lights Inserted in Walls—Protection of Footlights—Construction of Border Lights, Ducts and Shafts Conducting Heated Air From Lights—Protection of Stage Lights.) Gas and electric lights in the halls, passageways, corridors, lobbies, and other means of ingress to or egress from any such room shall be controlled by a separate shutoff, located in an accessible place, subject to the approval of the Commissioner of Buildings and controlled only in that particular place. No gas or electric light fixtures shall be inserted in the walls, woodwork, ceilings or in any part of any such room, unless protected by fireproof materials. The footlights, if gas lights, shall be protected by wire net work, and also by a strong wire guard, not less than two feet distant from such footlights, and a trough containing such footlights, shall be formed and be surrounded by fireproof materials. Border lights shall be constructed according to the best known methods subject to the approval of the City Electrician and shall be suspended by a wire rope. Ducts and shafts used for collecting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal, and made double with an intervening air space. Stage lights, if gas, shall have strong wire guards or metal screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of flame, and such guards or screens shall be firmly soldered to the fixtures in all cases.

352. Apparatus Under Control of Fire Marshal.) The standpipe, hose, vent flues, and all apparatus for the extinguishing of fire or guarding against same, required by the provisions of this chapter to be provided, shall be at all times so provided and kept in a manner satisfactory to the Fire Marshal.

353. Scenery Requirements—Fire Proof Solution.) (a) All scenery on the stage shall be made stationary, and shall consist of not over two asbestos curtains, three stationary wings on each side and four stationary border drops. All scenery and stage paraphernalia shall be treated with a paint or chemical solution every six months, which shall make it non-inflammable, and which treated scenery or stage paraphernalia shall be tested and approved by the Fire Marshal. Where no combustible scenery is used or where all scenery is made of metal, the smoke flue over the stage and the standpipes may be dispensed with at the discretion of the Commissioner of Buildings and the Fire Marshal.

(b) Scenery supported by and constructed entirely of incombustible material, shall not be considered as sets of scenery provided for in this section.

354. Dressing Room Partitions.) Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated.

355. Frontage Consents Required.) No building of this class shall hereafter be constructed for, or converted to the use of said class, unless frontage consents are secured as required by the ordinances of the City of Chicago and filed with the Commissioner of Buildings.

CLASS IVd

356. Class IVd Defined.) In Class IVd shall be included every grand stand and every baseball, athletic and amusement park.

357. Loads—Allowance for Live Loads.) The floors and stairs of grand stands and bleacher stands, existing or hereafter built,

shall be designed and constructed in such manner as to be capable of bearing in all their parts and supports, in addition to the weight of the floor construction, partitions and permanent fixtures, that may be set upon the same, a live load of not less than one hundred pounds for every square foot of surface of said floors, and a live load of not less than one hundred and fifty pounds for every square foot of the bearing surface of the stairs.

***358. Grandstands—Frame within Fire Limits—Grandstands Hereafter Constructed—Fireproof—Frontage Consents.)** (a) *Wooden grandstands or tiers of seats commonly known and described as grandstands now constructed or in the process of construction may be erected, repaired or enlarged within the fire limits where no part of any such structure shall be within sixty feet of any other building or structure. All grandstands hereafter erected within the fire limits, except as hereinafter provided, shall be made of fireproof or unprotected steel construction. The enclosing walls, if enclosed, shall be made of fireproof or incombustible materials, but the seats may be made of wood. Grandstands outside the fire limits, or inside the fire limits where the seating capacity does not exceed five thousand persons, may be constructed of wood, but no part of any such structure shall be within less than sixty feet of any other building or structure. The braces, supports and the underside of all seats, including bleacher seats, shall be treated with a fire-retarding solution once a year before opening up the premises containing such stand to the public.*

(b) *Every person, firm or corporation desiring a permit for the construction of a grandstand, except in connection with such as are now in existence, shall first obtain the consent in writing of the owners of a majority of the frontage on both sides of the street or streets on each side of the block or square in which it is desired to erect such grandstand.*

*Amend-d, Dec. 19, 1910.

359. Width of Aisles and Exits—Number of Seats Between Aisles.) (a) The width of aisles and exits in all grandstands contemplated in Section 356, hereafter constructed, shall be in no case less than 36 inches and such width shall be increased toward the exits which serve as regular entrances, such width being computed at the rate of eighteen inches per 100 seats or fractional part thereof in non-fireproof grandstands, and at the rate of twelve inches for each 100 seats or fractional part thereof in fireproof grandstands.

(b) The number of seats between aisles in any row shall not exceed twenty in non-fireproof grandstands, nor thirty in fireproof grandstands.

(c) No exit, gate or door, shall be locked or bolted during the occupancy of such stands by the public. All aisles, passageways, corridors and exits shall be kept free from obstructions of any kind.

360. Temporary Seating Structures.) Temporary seating structures for shows and outdoor exhibitions and the observation of holidays and special occasions may be built of combustible material, providing they are built structurally strong enough to support a live load of one hundred pounds per square foot, and comply with the provisions of Class IVb in regard to means of exit, aisles and rows of seats; and provided, further, that a permit be secured from the Commissioner of Buildings, which shall in no case be issued by him until the party desiring to erect said temporary seating structure shall secure the written consent of a majority of the property owners or their duly authorized agents, on both sides of the street between the two nearest intersecting streets on which said temporary seating structure is to be located. And further provided that any permit issued for any such temporary seating structure as herein-

above provided for in this section shall not entitle the person so receiving said permit to use said temporary seating structure for more than ten consecutive days from the first day on which it is so used; and further provided that any temporary seating structure provided for in this section shall be removed within ten days after the use of the same as provided for in this section, and if not so removed it shall be the duty of the Commissioner of Buildings to order the same to be removed or torn down by the Fire Marshal.

361. Use of Roofs Used for Spectatorial Purposes—Prohibited.) It shall be unlawful for any person, firm or corporation whether owner, lessee, manager or in possession and control or having charge of any building within the city to permit the use of the roof of any such building, whether free of charge, or through admission fee, to any person or persons as a place of observation or for spectatorial purposes

Amusement Parks.

362. Roller Coaster Devices.) No roller coaster, scenic railway, or other riding, sliding, or rolling device, shall be hereafter erected of a greater height from the ground than 55 feet. All such coasters, railways, riding or other devices shall be equipped with safety clutches. The cars, or any receptacles, which persons are permitted to occupy, or in which they are permitted to travel, ascend or descend, shall have hand rails of sufficient number and height to prevent people from being thrown therefrom, and of such character as shall be approved by the Commissioner of Buildings.

363. Frontage Consents Required.) It shall hereafter be unlawful for any person, firm or corporation, to build, construct, establish, produce or carry on, any amusement within any ground, garden or enclosure of the kind commonly known and described as amusement parks, wherein shows of different classes are offered or presented by one or more concessionaries, without first securing written frontage consents as required by the ordinances of the City of Chicago. Such frontage consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the construction of any building or structure connected in any way with such amusement park.

***364. Requirements.)** (a) Buildings hereafter erected within an amusement park, located outside the fire limits, shall comply, except as herein otherwise specified, with the provisions of Class IVb.

(b) Buildings hereafter erected within amusement parks located outside of the fire limits and not exceeding one story in height and which do not contain more than one balcony may be built with a self-supporting steel frame designed as required by this chapter. Such structures may be enclosed with metal lath covered with cement plaster, which plaster shall be not less than one and one-third inches thick, or such structures may be enclosed with galvanized iron. The roofs of such structures may be of ordinary construction supported on steel trusses and covered with a gravel or composition roof, approved by the Commissioner of Buildings.

(c) Every moving picture theatre hereafter built within an amusement park shall comply with the provisions of Class IVc.

*Amended June 26, 1911.

365. Open Space Between Buildings.) There shall be an open and unobstructed space of not less than four feet between each and every frame building hereafter

erected in an amusement park, where the buildings do not exceed twenty feet in height, and of not less than six feet where the buildings are over twenty feet and less than thirty feet in height, and of not less than ten feet where the buildings are over thirty feet in height. Where brick or concrete or other fireproof walls of full seven-teen inches in thickness are used between such buildings and where such buildings are built of slow-burning construction, these spaces shall not be required, but, in such cases, there shall be a space of ten feet in width at intervals of every two hundred feet.

366. Standpipes—Fire Plugs—Hose.) There shall be installed within the grounds of every amusement park, an adequate system of water pipes with branch connection to fire plug, with sufficient hose connected to city pressure, so as to furnish at all times a good and efficient force of water, which will enable the extinguishing of fire at or within each and every building. The size of water mains, standpipes, fire plugs, hose, as well as the location, number, and quantity of same, shall be subject to the approval of the Fire Marshal. All hose connection shall be the standard size used by the Fire Department of Chicago and shall be approved by the Fire Marshal.

367. Roller Coasters—Scenic Railways, Etc.—Permit Fee—Certificate of Test and Safety.) Before any roller coaster, scenic railway, water chute, or other mechanical, riding, sailing, sliding or swinging device is erected, either in existing or new amusement parks, a detailed plan shall be submitted to the Commissioner of Buildings, for his approval or rejection, and, if approved, a permit shall be procured by the person, firm or corporation desiring to erect such device. The permit fee shall be fifty dollars for each such device. Before such device is opened to the public each season, a certificate of inspection, signed by a competent engineer, approved by the Commissioner of Buildings, must be furnished, certifying to the practicability, strength and safety of such devices, and all such device or devices shall be examined by the Commissioner of Buildings or his employees upon completion and each year before opening up to the public.

368. Must Comply With All Ordinances.) It shall be unlawful for any person, firm or corporation to construct, alter or operate any amusement park or any building or structure therein unless they comply with the ordinances of the city relative thereto.

ARTICLE VIII.

(NOTE: See end of ordinance, page 180, for special ordinance on regulations for operating places of amusement.)

Class V.

369. Class V Defined.) In Class V shall be included every building which is used as a public theater where an admission fee is charged and in which movable scenery is used, and every assembly hall hereafter erected having a seating capacity of over 300 and containing a permanent stage on which scenery and theatrical apparatus are used and regular theatrical vaudeville performances are given; provided, however, that public halls and club halls with a seating capacity of less than six hundred, although occasionally used for theatrical presentation, shall not be considered as public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stages thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V as herein defined. Such public halls and club halls

shall be included in Class IV as defined in this section.

369½ Must Comply With General and Special Provisions.) Every building of Class V shall comply with the general provisions of this chapter and shall also comply with the following special provisions:

370. City Officers Empowered to Enter Buildings.) The Commissioner of Buildings, Commissioner of Health, Fire Marshal, City Electrician, Superintendent of Police, or any of them, and their respective assistants, shall have the right to enter any building used wholly or in part for the purposes of Class V, and any and all parts thereof, at any reasonable time, and at any time when occupied by the public, in order to examine such buildings, to judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them, or any of them, in the performance of their duties.

371. City Officers Empowered to Close.) The Commissioner of Buildings, Commissioner of Health, Fire Marshal, City Electrician and the Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class V, closed, where it is discovered that there is any violation of any of the provisions of the chapter, and keep same closed until such provisions are complied with.

372. License—Mayor Shall Revoke.) Upon a report to the Mayor by the Commissioner of Buildings, Commissioner of Health, Fire Marshal, City Electrician or the Superintendent of Police that any requirement of this chapter or that any order given by them or any of them in regard thereto has been violated, or not complied with, the Mayor shall revoke the license of any such theatre or place of amusement so reported and cause the same to be closed.

Buildings of Class V Now in Existence.

373. Buildings of Class V Now in Existence.) The following provisions shall apply to Class V buildings in existence at the time of the passage of this ordinance:

374. Walls—Outside—Must Comply with Requirements of Section 519.) The outside walls of all such buildings in existence at the time of the passage of this ordinance, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more shall comply with the requirements of Section 519.

375. Columns in Walls—Alterations.) If iron or steel columns are introduced in the walls referred to in Section 374, the brick work around the same shall be bonded into that of the connecting walls, and each of such columns shall be fireproofed as provided in Sections 624 and 625 of this chapter. All alterations in such existing buildings, to make them comply with the requirements of this chapter may be executed with the same kind of materials as those originally used in the construction of such buildings; provided, that after the said building is brought into compliance with the provisions of this chapter, then all subsequent alterations, enlargements, repairs, replaced or strengthened structural parts damaged by fire, wear and tear, or otherwise, shall be made of fireproof construction or iron or steel construction covered with fireproof materials, as provided by this chapter.

376. Other Classes Built in Conjunction with Class V—Doors for Openings Between Connecting Buildings.) In all cases where existing buildings used wholly or in part for the purposes of Class V are built in conjunc-

tion with or as part of buildings devoted to the uses of other classes and where such buildings of the other classes, as specified in this ordinance, are not built entirely of fireproof construction, double iron doors shall be placed at each connecting opening between such buildings of Class V and the building connected therewith.

***377. Floor Levels—Limitations of.)** (a) Any audience room used for the purposes of Class V *now in existence* containing in the aggregate not more than five hundred seats, if in a fireproof building, may be *maintained* in any story thereof, but in such case there shall be at least two stairways to the ground, from the floor or floors on which each such room is located, each of which stairways shall be not less than four feet in width in the clear.

(b) In existing buildings of fireproof construction, having an audience room with a seating capacity of more than five hundred and less than fifteen hundred, the lowest bank of seats of the main floor thereof shall be not more than twelve feet above the street level, and every such building shall in all other respects conform to the requirements of this ordinance. The main floor of any *existing theatre* of any kind of construction shall not be raised above its *present elevation*.

*Amended July 22, 1912.

378. Loads—Allowance for Live Loads in Construction of Floors of Class V.) For all buildings of Class V all floors shall be designed and constructed in such manner as to be capable of supporting in all their parts, in addition to the weight of floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

379. Stairways—Entrances and Exits.) (a) Stairways, affording egress from any room or rooms used for the purposes of Class V shall be equivalent in width to twenty inches for every one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches shall be added, but no such stairway shall be less than four feet wide in the clear, except as hereinafter provided in this section.

(b) All such stairways shall have hand railings on each side thereof and shall not ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall not be less than the width of the stairs. No run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over 7 feet wide shall have double intermediate handrails with end newel posts at least 5½ feet high.

(c) Steps shall not have a greater rise than 8 inches, treads shall not be narrower than 10 inches, and winders shall not be used on any staircase, except where circular staircases are expressly permitted.

(d) In existing theatres every balcony and gallery shall have separate and distinct entrance stairways from the sidewalk level, except that in cases where the vestibule or entrance to any such theatre is not more than fifteen inches, or two steps, above the sidewalk level and such steps are at or near the building line, the stairways to such balcony and gallery may ascend from the floor of such vestibule or entrance, but if the run of the stairs at the bottom is not toward the street, there shall be a hand rail or rails, three feet above the floor constructed from the foot of such stairways for a distance of not less than five feet leading toward the street. All

doors intervening between such stairways and the street shall, during each and every performance, be kept unfastened.

(e) There shall be an iron stairway or stairways from the stage to the fly galleries and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairways may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Every stairway leading to a box or boxes shall be independent of all other stairs or seats; and such stairway shall not be less than two feet eight inches wide in the clear, when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

(g) Every stairway on the stage side of the proscenium wall shall be not less than two feet six inches wide.

(h) Instead of increasing the width required for entrances, aisles, exits and stairways to that required by this chapter, the owner, lessee or manager of any such theatre shall have the privilege of reducing the number of permanent seats therein until the same ratio between such width and number of seats as hereinbefore provided for shall be established, and if such privilege be taken advantage of, it shall be the duty of the Commissioner of Buildings to make inspection and certify that such ratio actually exists before a license for the operation of any such theatre shall be issued.

330. Floors and Exits.) Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

331. Seats in Rows Between Aisles.)

(a) Not more than ten seats in any row shall be permitted between aisles in any gallery. On the main floor and balcony not more than eleven seats shall be permitted between aisles; except in rows of seats which are within twenty feet from the exits, in which case thirteen seats shall be permitted between aisles.

(b) Seats shall be not less than twenty inches in width measured at the top of the seat backs. Rows of seats shall be not less than two feet eight inches from back to back.

No bank of seats shall be of greater rise than twenty-two inches.

(c) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, except that groups of five seats or less may abut upon a tunnel at one side and an aisle at the other. And except that a bank of seats abutting boxes or walls on main floor, balcony, and gallery, of not over five seats in a row, shall be required to abut upon one aisle only.

(d) The number of banks of seats on the main floor shall not exceed fifteen unless an intervening or cross aisle is provided between each fifteen banks of seats or unless a direct exit is provided for each aisle.

(e) The number of banks of seats in the balcony shall not exceed nine unless an intervening or cross aisle is provided between each nine banks of seats or unless a direct exit be provided for each aisle.

332. Tunnels—Cross Aisles—Vertical Rise—Foyer.) (a) There shall be no more than twelve-feet rise measured vertically in any aisle in any gallery without a direct exit by tunnel or otherwise to a corridor with free opening on to the gallery stairs or other direct discharge to the street, or at such elevation of twelve feet an inter-

vening or cross aisle leading directly to an exit. No tunnel shall be less than three feet wide in the clear.

(b) No foyer shall be open to the theatre proper except through the exits.

333. Main Floor—Balcony and Gallery—Designation of.) (a) The lower floor of all theatres shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony," and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

334. Aisles, Corridors and Passageways—Kept Unobstructed—Steps in Aisles.) (a) The minimum width of aisles with diverging sides in any room used for the purposes of Class V shall be two feet eight inches at the end near the stage and not less than three feet at the other end.

(b) The minimum width of aisles with parallel sides shall be three feet.

(c) Every aisle shall lead as nearly as possible directly to an exit, but in no case shall the center line of such exit be more than three feet from the center line of any such aisle leading thereto.

(d) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be greater than 8 inches, and no tread shall be less than 10 inches, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated, but shall be grouped together and a light shall be maintained so that every place where there are steps in inclosing aisles or corridors shall be clearly lighted.

(e) All aisles passageways, corridors and exits shall be kept free from camp stools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles, passageways, corridors or exits during any performance, service, exhibition, lecture, concert or any public assemblage.

335. Corridors, Passageways, Hallways and Doors—Width of.) (a) The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridor shall be anywhere less than four feet in width, and no door less than three feet wide, except as otherwise herein provided.

(b) All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, check room or private office, shall lead directly to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least three feet in width in every part, and shall be unobstructed in every part except by doors, not less than three feet in width in the clear, which shall swing outward and which shall not have locks or catches of any kind whatever.

336. Doors—Entrance.) (a) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each one hundred permanent seats in the audience room and in addition thereto a proportionate part of twenty inches for the fractional part of one hundred seats shall be added.

(b) No mirror or architectural feature shall be so arranged as to give the appearance of a doorway, exit, hallway or corridor where none exists.

387. Dressing Room Partitions.) Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated.

388. Emergency Exits—Width—Emergency Stairs—Width—Emergency Exits Inside Walls of Buildings—Fire Escapes, Construction—Fire Escapes Leading to Street or Alley—Doors Open Outward.) (a) Emergency exits and stairways shall be provided separately for each door, balcony and gallery and shall be of the same aggregate width as that provided for the main exits, and shall not be less than three feet in width. Such emergency exits shall be kept free of obstructions of every kind, including snow and ice.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fireproof partition not less than four inches thick separating the exits and stairways from the audience room or auditorium.

(c) If said emergency exits lead outside the building, the opening leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall. Outside shutters will not be permitted, except when they open automatically from the interior, without resistance, and when used or open will automatically fasten, securely, flat against the wall, so as not to obstruct the passage on the outside; all such automatic devices or attachments to said doors or shutters shall be subject to the approval of the Commissioner of Buildings and the Fire Marshal of the City of Chicago.

(d) Whenever any such emergency stairway passes over an exit door, window or other opening, such stairway shall be completely inclosed for a space of five feet greater in width than such opening, by iron, steel or other incombustible material.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any doors, gates, bars or obstruction of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley, or street, without entering into or passing through or over any building unless by a fireproof passage at least four feet wide and seven feet high on the court or ground level.

(g) All doors in openings from any and all exits and stairways shall be so constructed that when opened they shall not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward and such doors shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

389. Wall—Brick Proscenium Wall Between Auditorium and Stage—Steel Curtain Fireproofed on Stage Side—No Combustible Material on Audience Side—Plans for Curtains—Permit from Building Department—Inspection Fee.) (a) There shall be in every theatre a solid brick wall of the same construction and thickness as is required in outside walls between the auditorium and the stage. The main proscenium opening shall have a substantial steel curtain vertically operated and fireproofed on the stage

side, which shall be raised and lowered by mechanical power and shall be in constant use as the regular curtain and act drop. In vaudeville houses said curtain shall be lowered at least once during each performance.

(b) No combustible material other than painted decorations shall be applied to the audience side of such curtains.

(c) Plans for such curtains shall be approved by the Commissioner of Buildings and a permit obtained previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, for which inspection a fee of five dollars shall be charged.

(d) All other openings in such proscenium wall shall have iron doors, frames and thresholds.

390. Stage—Construction of—Fireproof Paint—Scenery—How Treated.) (a) The framing of the floor of every stage shall be of iron or steel. The stage floor may be of wood not less than one and three-fourths inches thick, and the under side of stage floor shall be saturated with a fireproof solution satisfactory to the Fire Marshal. The entire floor construction and floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and cables, and their supports, shall be of iron or steel. All woodwork and all framing for scenery used on or about the stage shall also be saturated with a fireproof solution, the same as prescribed for stage flooring.

(b) Counter weighting of scenery must be done with incombustible weights carried on steel cables and operated in grooves or slotted channels; except that small sandbags, weighing not over eight pounds, may be used to bring down scenery ropes to stage level.

(c) No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for theatrical purposes, unless such scenery and paraphernalia shall have been treated with a fireproof or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

391. Vestibule for Stage Doors.) All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings so as to protect the curtain, scenery and auditorium against draughts of air.

392. Vents—Flue Pipes, Size of—Dampers—Switches for Dampers.) (a) One or more vents, or flue pipes, of metal construction or other incombustible material, suitable for carrying away smoke, approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord

will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

(d) All fuse boxes shall be surrounded by two thicknesses of fireproof material, with an air space between, and no fuses shall be exposed to the air between the switch board.

393. Automatic Sprinklers—Location of—Tank—Connections.) (a) An approved system of automatic sprinklers shall be provided in every theatre of this class, with approved automatic closed circuit electric devices, connecting the valves regulating the flow of water in the various sprinkler pipes, with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal shall direct, so arranged as to prevent any tampering with the system or the shutting off of the water from the sprinkler pipes, without automatic notice to the Fire Department.

(b) Such system of automatic sprinklers shall be supplied with water from a tank located not less than twenty feet above the level of the highest sprinkler head in the system, and it shall be the duty of the fireman provided for in this ordinance to include in his daily report the result of an inspection to determine the sufficiency of water in this tank. Automatic sprinklers shall be placed in the paint room, store room, property room, scene-storage room, carpenter shop and dressing rooms. If such rooms are in or connected with a building used for the purposes of Class V, such tank shall not be connected with a standpipe and ladder system, but shall be filled through a separate pipe from a fire pump, and a three-inch iron pipe shall extend from such tank to the outside of such building, with Siamese connections, for fire department use. Such entire automatic sprinkler system and equipment and the location thereof shall be subject to the approval of the Fire Marshal.

***394. Fire Apparatus on Stage—Hand Fire Pumps—Fire Apparatus.)** (a) A standpipe not less than two and a half inches in diameter, having a hose valve or valves thereon, shall be installed on each side of the stage, with a hose connection at the stage and at each floor above and below the stage. Such standpipes shall be connected with a frost protected tank on the roof, containing not less than 2,000 gallons of water, and also with a power pump. A length of approved one and one-half inch unlined linen hose, with five-eighths inch smooth bore nozzle, shall be attached to each outlet. Hose, when not in use, shall be mounted on self-releasing racks of approved pattern. Approved portable fire extinguishers or hand fire pumps, shall always be kept ready for use on and under the stage, in fly galleries and in rigging lofts, and, in addition thereto, at least four fire department axes and six pike poles shall be kept ready for use on each tier or floor of the stage.

(b)

*Amended October 30, 1911, by striking out paragraph (b).

(c) All of the above mentioned equipment shall be installed and maintained under the direction of and subject to the approval of the Fire Marshal.

(d) The use of ordinary hot-air furnaces or stoves is prohibited.

395. Lighting—Independent Lighting System for Exits—Red Lights Over Exits.)

(a) All stairways and corridors shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building and shall be in operation during the entire period such theatre is open to the public and until the audience has left the building. The word "EXIT" shall appear in letters at least six inches high over the opening to every means of egress from such theatre and a red light furnished by gas or sperm oil shall be provided over such sign.

(b) In every theatre, every portion thereof devoted to the use or accommodation of the public, and all outlets therefrom leading to the streets, including open courts, corridors, stairways, exits and emergency stairways, shall have gas or electric lighting equipment to properly illuminate such rooms and spaces, and every passageway, court, corridor, stairway, exit and emergency stairway shall be provided with signs indicating the way out of the building, the letters of which shall not be less than six inches in height.

396. Lights—Control of Lights in Halls, Corridors and Lobbies—Separate Shut-off—Connections with Gas Mains—Independent Connections—Protection of Suspended and Bracket Lights—Protection of Lights Inserted in Walls—Protection of Footlights—Construction of Border Lights—Ducts and Shafts Conducting Heated Air from Lights—Gas Stage Lights to Have Metal Screens.) Gas and electric lights in the halls, corridors, lobbies or any other part of any theatre used by the audience, except the auditorium, shall be controlled by a separate shut-off, located in the lobby, and controlled only in that particular place. Gas mains supplying such theatre shall have independent connections for the auditorium and the stage, and provisions shall be made for shutting off the gas from the outside of the building. Suspended or bracket lights surrounded by glass in the auditorium, or in any other part of the theatre, shall be provided with proper wire netting underneath. No gas or electric lights shall be inserted in the walls, woodwork, ceilings, or in any part of the theatre, unless protected by fireproof materials. Border lights shall be constructed according to the best known method and subject to the approval of the Fire Marshal and the City Electrician, and shall be suspended by wire rope. Ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between. Gas stage lights shall have strong metal wire guards or screens not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flames of such lights, and shall be soldered to the fixtures in all cases.

397. Fire Apparatus—Under Control of Fire Department.) The standpipes, automatic sprinklers, gas pipes, electric wires, hose, footlights, fire alarm boxes, fireproof proscenium curtain, switch boxes, ventilators, controlling levers, axes and pike poles, and all apparatus for the extinguishing of fire or guarding against the same, as provided for by this ordinance, shall be made and kept at all times in condition satisfactory to and under the control of the Fire Marshal.

398. Fire Alarm Apparatus.) Every theatre shall be provided with an approved system of automatic or manual fire alarm telegraph apparatus connected by the necessary wires with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal may direct. The number and location of the boxes and

the character of the system, whether automatic or manual, or both, shall be determined by the Fire Marshal.

399. Capacity—Certification for License.) The Commissioner of Buildings shall determine the number of persons which every room used for the purpose of Class V may accommodate according to the provisions of this chapter and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

***400. Theatres in Frame Buildings Prohibited.)** On and after July first, 1911, no frame building, or part thereof, within the city, shall be used as a moving picture, vaudeville or other theater; *provided, that nothing herein contained shall be held to apply to any frame building existing at the time of the passage of this ordinance and in which a moving picture, vaudeville or other theater is being maintained at the time of the passage of this ordinance, where all the scenery, if any, used in connection with such moving picture, vaudeville or other theater, is constructed of either sheet-metal or asbestos, and where the amount of exit space for such theater is at least fifty (50) inches for each one hundred (100) seats therein contained, and where there is no living apartment of any kind used, maintained or occupied as such in any part of said building.*

**Amended June 26, 1911.*

To Buildings of Class V Hereafter Erected.

The following provisions shall apply to buildings of Class V hereafter erected and used wholly or in part for such purposes:

401. Construction—Walls—Outside Walls—Structures.) All buildings of Class V hereafter erected shall be built of fireproof construction.

402. Frontage—Open Spaces—Fireproof Passageways.) (a) All buildings hereafter erected used wholly or in part for the purposes of Class V shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten (10) feet in width.

(b) The audience room of every such building used for the purposes of Class V shall have either a public thoroughfare or an open space not less than ten feet wide extending from the lowest first floor level to the sky, on each of the two sides other than the proscenium and the foyer. Exit doors shall open onto such public thoroughfare or the bottom of such open space from the respective sides of the stage and of the main floor of the audience room, and onto balconies or platforms built in such public thoroughfare or open space at both the highest and the lowest floor levels of each and every balcony and gallery and the doors opening into such public thoroughfare or open space from any balcony or gallery or from the main floor shall comply with all the requirements prescribed in Section 410 of this chapter.

(c) All such balconies or platforms shall be connected with stairway fire escapes leading to the street level or to the bottom of such open space and in the latter case they shall have their bottom run toward the public thoroughfare and such balconies or platforms and such fire escapes shall comply with all the requirements prescribed in Sections 669, 670 and 673 of this chapter. Every such open space, if it does not open onto a public thoroughfare shall communicate with the public thoroughfare at the front side of the theatre by a fireproof passageway leading from the bottom level of such open space to the sidewalk level. Where there is a public thoroughfare behind the stage every such open space shall also communicate with such public thoroughfare

by a fireproof passageway leading from the bottom level of such open space to the level of the public thoroughfare behind the stage, and passing under the stage.

(d) The walls of a fireproof passageway shall be not less than four inches thick, and each and every part of such passageway, including each and all of its supports, shall be built of fireproof construction as required in the general provisions of this chapter relating thereto.

(e) Radiators for warming passageways shall be in recesses sufficient in depth to prevent them from obstructing the passageway.

(f) There shall be no steps or risers in fireproof passageways, but where necessary, inclined floors of the full width of the fire of the floor shall not exceed two and one-half inches in height per foot measured horizontally, and no such incline shall be proof passageway may be built; the incline less than ten feet in length. No fireproof passageway shall be less than ten feet wide and eight feet high in any part thereof except at doors, and these door openings shall be not less than eight feet wide and seven feet high.

(g) If the principal entrance corridor of a theatre is at one side and approximately at right angles to the central axis of the audience room, then the center line extended of such principal entrance shall intersect the center axis of the stage and the audience room between the back of the seat most remote from the stage, on said center axis of the stage and the audience room and at a point midway between such seat and the wall opposite the proscenium wall.

403. Buildings of Other Classes Built in Conjunction with Class V.) If buildings used wholly or in part for purposes of Class V, are built in conjunction with or as part of buildings devoted to the uses of other classes, then such buildings of other classes shall be built of fireproof construction.

***404. Floor Levels—Live Loads.)** (a) *The floor level of the highest bank of seats on the main floor shall not be more than three feet above the sidewalk level and the floor level of the lowest bank of seats shall not be more than eight feet below the sidewalk level.*

(b) *All floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, permanent fixtures and mechanisms that may set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.*

**Amended July 22, 1912.*

405. Stairways—Entrances and Exits.)

(a) Stairways affording ingress to or egress from any room used for the purposes of Class V shall be in width equivalent to twenty inches for each one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches of width shall be added, but in no event shall any such stairways be less than four feet in the clear, except as hereinafter provided.

(b) All such stairways shall have hand rails on each side thereof, and shall not ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall be not less than the width of the stairs; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over seven feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high.

(c) Steps shall not have a greater rise than eight inches, treads shall not be nar-

rower than eleven inches, and winders shall not be used on any staircase.

(d) Every balcony and gallery shall have one or more separate and distinct exits and stairways to the sidewalk level. All gallery stairways shall lead to the top gallery and there shall be doors in same at each floor for exit purposes only. The bottom run of the stairs shall be directly toward the street. Such stairs may ascend from the vestibule or entrance inside of the buildings, but the bottom riser of such stairs shall be not more than sixty-five feet from the building line. All doors between such stairs and the street shall be kept unlocked and unfastened during each and every performance and until the audience has left the building.

(e) There shall be an iron stairway or stairways from the stage to the fly gallery and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairway may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Stairs leading to a box or boxes seating not to exceed thirty people in the aggregate shall be independent of all other stairs and seats, and not less than two feet eight inches wide in the clear. For each additional twenty-five persons for whom seating capacity is provided, or major portion thereof, in such box or boxes there shall be an additional five inches in width of such stairway.

(g) All stairways on the stage side of the proscenium wall shall be not less than two feet six inches wide.

406. Floors at Exits — Seating.) (a) Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

(b) There shall not be more than ten seats in any one row between aisles.

(c) Seats shall not be less than twenty-two inches in width, measured at the top of the seat backs.

(d) Rows of seats shall not be less than two feet ten inches from back to back.

(e) No bank of seats shall have a greater rise than twenty inches. A bank of seats abutting boxes or wall on main floor, balcony or gallery of not over five seats in a row, shall be required to abut upon one aisle only.

(f) Seats in loges and boxes shall be limited in the ratio of one seat for every six hundred and eighty square inches of floor area in such loge or box.

(g) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, provided groups of five seats or less may abut upon a tunnel at one side and an aisle on the other side.

(h) The number of banks of seats on the main floor shall not exceed fifteen, unless an intervening or cross aisle is provided between each fifteen banks of seats or a direct exit is provided for each aisle. The number of banks of seats in the "balcony" and "galleries" shall not exceed nine, unless an intervening or cross aisle is provided between each nine banks of seats or a direct exit is provided for each aisle.

407. Tunnels—Cross Aisles—Vertical Rise—Foyer.) (a) There shall be no more than eleven feet rise, measured vertically, in any aisle in any gallery without a direct exit by tunnel or otherwise, to a corridor with free opening onto the gallery stairs or other direct discharge to the street or at any such elevation of eleven feet an intervening or cross aisle leading directly to an exit.

No tunnel shall be less than four feet wide in the clear.

(b) No foyer shall be open to the theater proper except through the exits.

408. Main Floor—Balcony and Gallery—Designation of.) (a) The lower floor shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony" and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

409. Aisles and Passageways—Steps in Aisles.) (a) The minimum width of aisles with divergent sides in any room used for the purpose of Class V shall be two feet eight inches at the end nearest the stage and not less than three feet at the other end. The minimum width of aisles with parallel sides shall be three feet.

(b) Every aisle shall lead directly to an exit. Any exit located at the end of any aisle and at right angles thereto shall be considered a direct exit.

(c) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be more than eight inches in height, and no tread shall be less than ten inches in width, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisle shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be inclosed but shall be grouped together, and a light shall be maintained so that every place where there are steps in inclosing aisles or corridors shall be clearly lighted.

410. Corridors—Passageways—Hallways and Doors—Width of.) (a) The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting however, that no corridors shall be less than five feet in width and no doorway less than three feet wide, except as otherwise herein provided.

(b) All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, cloak room, check room, or private office, shall permit of free passage, without returning, to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least four feet in width in every part between such balcony or gallery and such outer exit, and shall be unobstructed in every part, except by doors not less than three feet in width in the clear, which shall swing outward and which shall not be provided with locks or catches of any kind whatever.

(c) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each 100 permanent seats in the audience room, and in addition thereto a proportionate part of twenty inches for the fractional part of 100 seats remaining shall be added.

(d) No mirror or architectural feature shall be so arranged as to give the appearance of a doorway, window, exit, hallway or corridor where none exists.

411. Emergency Exits—Width—Emergency Stairs, Width—Emergency Exits Inside Walls of Buildings—Fire Escapes, Construction—Fire Escapes Leading to Street or Alley—Doors Open Outward.) (a) Emergency exits and stairways shall be provided separately for each floor, balcony or gallery and shall be of the same aggregate width as that provided for the main exits, and shall not be less than three feet in width. Such emergency stair-

way shall be made of iron, steel or other incombustible material. Such emergency exit shall be kept free of obstructions of every kind, including snow and ice.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fireproof partition not less than four inches thick, separating the exits and stairways from the audience room or auditorium.

(c) If such emergency exits lead outside the building, the openings leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall, and outer shutters shall not be permitted.

(d) Whenever any such emergency stairway passes over an exit, door, window or other opening, such stairway shall be completely inclosed for a space of five feet greater in width than such opening, by iron, steel or other incombustible material.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any door, gate, bars or obstruction of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley or street without entering into or passing through or over any building unless by a four-foot wide fireproof passage on the court or ground level.

(g) All doors in openings from emergency exits and stairways shall be so constructed that when opened they will not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward and shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

412. Wall—Brick Proscenium Between Auditorium and Stage—Steel Curtain Fireproofed on Stage Side—No Combustible Material on Audience Side—Plans for Curtain—Permit from Building Department.) (a) There shall be a solid masonry wall of the same construction and thickness as is required in the outside walls of the building in which such theatre is located between the auditorium and the stage.

(b) The main proscenium opening shall have a vertically operated steel curtain which shall, when it is lowered, completely close such proscenium opening. The curtain shall be raised and lowered by hydraulic power, and shall be in constant use as the regular curtain and act drop. In vaudeville houses said curtain shall be lowered at least once during the performances.

(c) The lowering of the curtain shall be controlled from not less than two points in the building, one of which shall be from the stage level and the other shall be designated by the Commissioner of Buildings.

(d) The curtain shall have a steel covering on the outer or auditorium side. The stage side covering shall be of a non-heat-conducting substance of such a thickness and such material as shall stand a test of two thousand degrees Fahrenheit on the stage side for fifteen minutes without heating the opposite side to a higher temperature than three hundred and fifty degrees Fahrenheit.

(e) All metal work with the exception of the frame shall be covered with such non-heat-conducting substances on the stage side.

(f) The curtain shall operate vertically in steel guides of such a cross section that the edges shall engage and secure the edges of the curtain and prevent the curtain from leaving the guiding channel or channels if the curtain should tend to buckle or bag either inward or outward. No metal in the guide channel or in the engaging edge of the curtain shall be less than three-eighths of an inch thick. The joints of the curtain with the proscenium wall, with the stage floor and with the head of the opening shall be made gas tight as nearly as practicable.

(g) The calculations for the strength of the curtain, the curtain guides and the guide anchors, and the workmanship, shall be according to the best modern engineering practice. The stresses in the material and in the various sections of steel shall be within the safe limits of stress described in this ordinance.

(h) No part of a curtain or of the curtain guides shall be supported by or fastened by any combustible material.

(i) The supports of the curtain and the curtain guides and edges and the curtain shall be of sufficient strength to safely resist either inward or outward a pressure of five pounds for each and every square foot of the curtain.

(j) No combustible material other than painted decorations shall be applied to the audience side of any such curtain.

(k) Plans for every such curtain shall be approved by the Commissioner of Buildings and a permit obtained therefor previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, and for each such inspection a fee of five dollars shall be charged.

(l) Every other opening in such proscenium wall shall have self-closing regulation standard iron fire doors and iron frames and thresholds; such doors and frames shall be built in such a manner as to resist warping.

413. Stage, Construction of—Fireproof Paint—Scenery—How Treated.) (a) The framing of the floor of every stage shall be of iron or steel or fireproof material. The stage floor may be of wood not less than two and three-fourths inches thick. The entire floor construction and fly galleries, rigging lofts and paint galleries, all stairways and supports and stanchions therein and all sheaves, pulleys, cables and other supports shall be of iron or steel. The woodwork of the stage floor shall be saturated with a fireproof solution satisfactory to the Fire Marshal. All other woodwork and all framing for scenery on or about the stage shall be coated with fireproof paint, which shall be submitted to and approved by the Fire Marshal. All wood used for the floor supports shall be saturated with a fireproof solution satisfactory to the Fire Marshal.

(b) Counter weighting of scenery must be done with incombustible weights carried on steel cables and operated in grooves or slotted channels; except that small sand bags weighing not over eight pounds may be used to bring scenery ropes down to stage level.

(c) No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for the purposes of Class V unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal. All

draperies in the auditorium, including the drop curtains, must be fireproofed at least once a year, subject to the approval of the Fire Marshal.

414. Vestibules for Stage Doors.) All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings, so as to protect the curtain, scenery and auditorium against draughts of air.

415. Structures Over Ceiling—Construction.) If any structure is built over the ceiling or roof of any theater, the different members of the girders or trusses supporting same shall be fireproofed in the manner prescribed for columns of fireproof buildings as specified in the General Provisions of this chapter.

416. Vents—Size of—Flue Pipes—Dampers—Switches for Dampers.) (a) One or more vents or flue pipes of metal construction, or other incombustible material, suitable for carrying away smoke, and approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof, and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional story.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

(d) All fuse boxes shall be surrounded by two thicknesses of fireproof materials, with an air space between, and no fuses shall be exposed to the air between the switchboards.

417. Automatic Sprinkler—Location—Tank—Connections.) (a) An approved system of automatic sprinklers shall be provided in theatres of this class, which shall comply with the following requirements: (1st) Said sprinkler heads shall be placed in the paint room, store room, property room, scene storage room, carpenter shop, and dressing rooms and spaced according to the best fire protection practice; (2nd) Said system shall be supplied by a frost-protected gravity tank of not less than 5,000 gallons capacity located above stage roof and bottom of tank shall be not less than twenty-five feet above the highest sprinkler head, or by an automatic centrifugal pump of not less than 500 gallons capacity per minute against 100 pounds pressure at the pump; (3rd) Said gravity tank, if used, shall be entirely independent of any standpipe system, unless the tank is of sufficient capacity to supply both systems and unless the supply pipe to standpipe is so arranged that it can not reduce the sprinkler system supply; (4th) Said gravity tank, if used, shall be filled through a supply pipe at least one

and one-half inches in diameter from fire pump hereinafter provided for in this chapter; (5th) There shall be a pipe of not less than three-inch diameter connected to the sprinkler system and extending to the outside of the building with a Siamese steamer connection properly placarded and suitable for Fire Department use; (6th) There shall be an approved system of local alarms with a bell in the ticket office, a buzzer in the lobby and on the stage and a bell and annunciator in the basement or in the boiler or engine room; all necessary gauges, including altitude gauge for tank riser, shall be located on main floor. Swing checks and gates shall be provided.

(b) The entire sprinkler system and equipment and the location, installations and maintenance thereof, shall be subject to the approval of the Fire Marshal.

418. Fire Apparatus on Stage—Hand Fire Pumps—Fire Apparatus.) There shall be installed on each side of the stage a standpipe of not less than three inches in diameter with a hose connection at the stage floor and at each floor level above and below the stage, which standpipe shall be supplied by a frost-protected gravity tank of a capacity of not less than 5,000 gallons. The bottom of said gravity tank shall be elevated at least twenty-five feet above the highest hose outlet and said gravity tank shall be equipped with a centrifugal power pump with hand controller, which power pump shall have a pumping capacity of not less than three hundred gallons per minute against fifty pounds pressure at the stage roof, except in cases where an automatic pump is installed which shall comply with the provisions of Section 417 of this chapter, in which event such pump may be used as a source of supply for standpipes. In addition to the above requirements of this Section there shall be a pipe of not less than three inches in diameter connected to the standpipes and extending to the outside of the building and equipped with a Siamese steamer connection properly placarded for and suitable for fire department use. All gravity tanks shall be filled through not less than one and one-half inch connection from pump and shall be provided with gauges, swing checks and gate valves. Each standpipe shall have one and one-half-inch hose outlet above, below and on the stage. Such outlet shall be provided with a straightway hose and a valve and drop cock connection. A length of approved one and one-half-inch unlined linen hose shall be attached to each outlet, which said linen hose shall have a five-eighths of an inch smooth bore nozzle. All hose shall be mounted on self-releasing racks when not in use. The entire equipment shall be installed under the direction of and subject to the approval of the Fire Marshal. Portable fire extinguishers or hand fire pumps shall be kept ready for use on and under the stage and in the flies, galleries and rigging loft. There shall be kept for use in every theatre of this class at least four fire department axes and six pike poles on each tier or floor of the stage, all of which shall be subject to the approval of the Fire Marshal.

419. Hot Air Furnaces.) The use of ordinary hot air furnaces or stoves in all theatres of Class V is prohibited.

420. Independent Lighting System for Exits—Red Light Over Exits.) All stairways and corridors shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building. The word "EXIT" shall appear in letters at least six inches high over the opening to every means of egress from such theatre and a red light furnished

by gas or sperm oil, shall be provided over such sign.

421. Fire Alarm Apparatus.) Every theatre shall be provided with an approved system of automatic or manual fire alarm telegraph apparatus, connected by the necessary wires with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal shall direct. The number and location of the boxes and the character of the system, whether automatic or manual, or both, shall be determined by the Fire Marshal.

422. Dressing Room Partitions.) Partitions forming dressing rooms shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated.

423. Capacity—Certificate for License.) (a) The Commissioner of Buildings shall determine the number of persons which each room used for the purpose of Class V may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

(b) No license for the operation of a theatre shall be issued unless the Commissioner of Buildings, Fire Marshal and City Electrician shall first have certified in writing that such theatre complies with the provisions of this chapter in every respect.

424. Lighting Equipment.) Every room used for the purposes of Class V, and all outlets therefrom leading to the streets, including passageways, courts, corridors, stairways, exits, and emergency stairways, shall have gas or electric lighting equipment to properly illuminate such room and spaces, and every passageway, court, corridor, stairway, exit, and emergency stairway, shall be provided with signs, indicating the way out of the building, the letters of which shall not be less than six inches in height.

425. Lights—Control of Lights in Halls, Corridors and Lobbies—Separate Shutoff—Connections with Gas Mains—Independent Connections—Protection of Suspended and Bracket Lights—Protection of Lights Inserted in Walls—Protection of Footlights—Construction of Border Lights—Ducts and Shafts Conducting Heated Air from Lights—Gas Stage Lights to Have Metal Screens.) Gas and electric lights in the halls, corridors, lobbies or any other part of any theatre used by the audience, except the auditorium, shall be controlled by a separate shutoff located in the lobby and controlled only in that particular place. Gas mains supplying such theatre shall have independent connections for the auditorium and the stage, and provision shall be made for shutting off the gas from the outside of the building. Suspended or bracket lights surrounded by glass in the auditorium, or in any other part of the theatre shall be provided with proper wire netting underneath. No gas or electric lights shall be inserted in the walls, woodwork, ceiling, or in any part of the theatre unless protected by fireproof materials. The trough containing footlights shall be formed of and surrounded by fireproof material. Border lights shall be constructed according to the best known methods, and subject to the approval of the Fire Marshal and the City Electrician, and shall be suspended by wire ropes. Ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between. Gas stage lights shall have strong wire metal guards or screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flames of such lights, and shall be soldered to the fixtures in all cases.

426. Fire Apparatus to Be Under Control of Fire Department.) The standpipes, automatic sprinklers, gas pipes, electric wires, hose, footlights, fire alarm boxes, fireproof proscenium curtains, switch boxes, ventilators, controlling levers, axes and pike poles, and all apparatus for the extinguishing of fire or guarding against same, as provided for by this ordinance, shall be made and kept at all times in condition satisfactory to and under control of the Fire Marshal.

427. Scenery—Definition—Movable Scenery.) (a) "Scenery" as used in this chapter shall include all scenery, drop curtains, borders and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

(b) "Movable Scenery" shall include all scenery, drop curtains, borders, and wings which are made movable for the purpose of changing an entire set of scenery and substituting another set during or between the various stage acts.

428. Communication Between Box Office, Stage and Fly Galleries.) A system of telephonic communication, subject to the approval of the Commissioner of Buildings and the City Electrician shall be installed between the box office, both sides of the stage, fly galleries, gridiron and space beneath the stage.

429. Changing from Class IV to Class V.) Whenever an existing Class IV theatre is changed into a Class V theatre, the same shall be made to comply with all of the provisions for Class V theatres hereafter erected.

ARTICLE IX.

Class VI.

430. Class VI Defined.) In Class VI shall be included every tenement and apartment house or building or portion thereof, which is used or intended to be used as a home or residence for two or more families living in separate apartments.

431. Requirements—General.) Every building of Class VI shall comply with the provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

***432. Definition of "New Tenement House"—"Apartment"—"Yard"—"Court"—"Shaft"—"Public Hall"—"Stair Hall"—"Basement"—"Cellar"—"Story"—"Solid Masonry").** (a) "New tenement house" shall include every tenement, flat and apartment house hereafter erected and every tenement house which shall be increased or diminished in size or otherwise altered after its erection and every building now or hereafter in existence not now used as a tenement house but hereafter converted or altered to such use.

(b) "Apartment" is a room or suite of two or more rooms occupied or intended or designed to be occupied as a family domicile.

(c) "Yard" is an open unoccupied space on the same lot with a tenement house, separating every part of every building on the lot from the rear line of the lot.

(d) "Court" is an open, unoccupied, unobstructed space other than a yard, on the same lot with a tenement house; a court entirely surrounded by a tenement house is an "inner court"; a court bounded on one side and both ends by a tenement house, and on the remaining side by a lot line is a "lot line court"; a court extending to a street, alley or yard is an "outer court."

(e) "Shaft" includes exterior and interior shafts, whether for air, light, elevator, dumb waiter or any other purpose; a "vent shaft" is one used solely to ventilate or light a water closet compartment, bath room, or pantry.

(f) "Public Hall" is a hall, corridor or passageway not within an apartment.

(g) "Stair Hall" includes the stairs, stair landings and those portions of the public halls through which it is necessary to pass in getting from the entrance floor to the top story.

(h) "Basement" is a story partly, but not more than one-half below the level of the inside sidewalk grade of the street nearest the building. If the floor of such basement is less than two feet (2 ft.) below such grade or if the ceiling of such basement is more than seven feet, six inches (7 ft. 6 in.) above said grade, said story shall be classed as the first story of the building in which it occurs. *Provided, however, that the ceiling height may be raised above the height of seven feet, six inches (7 ft. 6 in.) heretofore given, not more than one-third of an inch for every foot of such distance said building is set back from the street line of the street nearest the building, but in no case shall any rise of ceiling be allowed for any distance beyond thirty feet (30 ft.) said building may be set back from the line of the street nearest the building, and in such cases all rises in the basement ceiling shall be computed according to the distance between the street line and the outside wall of the building nearest to said street line. And further provided, that the yard or ground level, or walks, or other improvements thereon for a distance of twelve feet (12 ft.) at every point from all outside walls of said building shall not be lower than eight feet three inches (8 ft. 3 in.) below the floor level of the first story of said building.*

*Paragraph (h) was first amended July 2, 1914, and again amended to read as above, February 8, 1915.

(i) "Cellar" is a story more than one-half below the level of the inside sidewalk grade of the street nearest the building.

Where the grade of a street adjacent to a tenement house varies, the average grade of such street opposite the lot containing the tenement house shall be regarded as the grade of such street within the meaning of this Chapter.

*Amended July 2, 1914.

(j) "Story" is that portion of a building between the top of any floor beams and the top of the floor or ceiling beams next above.

433. Sections—Where Conflicting With Other Sections.) In cases of direct conflict with the provisions of other sections of this ordinance relating to other classes, the provisions of the sections relating to Class VI shall govern in respect to tenement houses.

434. Changes or Alterations—Permits.) Every new tenement house and every change or alteration in any existing tenement house shall conform to the requirements of this chapter. No new tenement house shall be begun, nor shall any changes or alterations in any existing tenement house, such as are referred to in this chapter, be begun until a permit therefor shall have been issued by the Commissioner of Buildings. Such permit shall be issued only upon an application by the person, firm or corporation for whom the building is to be erected or altered, and after approval of the plans and specifications for such tenement house or for such changes or alterations by the Commissioner of Health whenever such approval is required by the ordinances of the City of Chicago.

435. New Tenement House—When to be Occupied.) (a) No new tenement house shall be occupied in whole or in part for human habitation until the issuance of a certificate by the Commissioner of Health that said building conforms to the requirements of this chapter relative to light and ventilation, plumbing and drainage applicable to said buildings, nor until the issuance by the Commissioner of Buildings of a certificate that the said building conforms to

the requirements of this chapter relative to fire escapes and means of egress applicable to new tenement houses. Within five days from date of application for any certificate above mentioned, such certificate shall be issued or the official concerned shall state in writing his reasons for his refusal to issue said certificate.

(b) The certificate above referred to may be issued in the case of a new tenement building comprising more than three apartments so as to allow the occupation of any section of the building extending from cellar to roof in advance of the completion of the other portions of the building.

(c) When the outer walls of a new tenement house have been erected so as to outline the position of the courts and shafts required for the lighting and ventilation of habitable rooms, the owner of the building or his representatives shall be entitled, upon application in writing, to an inspection of the same by the Commissioner of Buildings, and if the work to that point is in compliance with the provisions regarding the size of shafts and the location of the building, to a certificate setting forth those facts.

(d) When the work of constructing partitions has advanced to a degree on any floor, that the rooms on that floor are determined in their dimensions, the owner or his representatives shall be entitled to an inspection from the Commissioner of Buildings, and if the rooms thus outlined conform in their dimensions to the plans filed and to the requirements of this chapter, to a certificate stating that fact.

(e) If a new tenement house is occupied as a place of habitation in any of its parts in violation of this section, it shall forthwith be subject to notice from the Commissioner of Buildings and shall be vacated upon such notice and shall not again be occupied until made to conform with the provisions of this chapter nor until after the issuance of the two certificates required in this section.

436. Plat to be Filed.) At the time of applying for a permit for the erection of, alteration of, addition to or moving of a tenement house or for the erection, alteration, adding to or moving of any building upon a lot upon which a tenement house stands, the applicant shall submit to the Commissioner of Buildings a plat of the lot, showing the dimensions of the same and the position to be occupied by the proposed building or by the building to be altered or added to or by the building to be moved thereon, and the position of any other building or buildings that may be on the lot. The measurements shall in all cases be taken at the top of the first story and shall not include any portion of any street or alley.

437. Corner Lot Defined—Frontages.) By "corner lot" is meant a lot situated at the junction of two streets or of a street and a public alley at least sixteen feet wide, provided that if such alley be less than sixteen feet wide, and the lot be estimated on a line sixteen feet from the opposite side of the alley, such lot may be considered a corner lot. Any portion of the width of such lot distant more than fifty feet from such junction shall not be regarded as part of a corner lot, but shall be subject to the provisions of this chapter respecting other than corner lots. Where, in corner lots, the two frontages are of unequal length, the lesser street frontage shall be taken as the width of the lot. Street frontage alone, and not alley frontage shall be considered in determining such lesser frontage.

438. Height—How Measured.) (a) The height of a new tenement house shall not exceed by more than one-half the platted width of the widest street on which it abuts, and no existing tenement house shall be increased beyond such height.

(b) Provided, however, that any distance the building sets back from the lot line shall be added to the width of the street in making this computation. Such height shall be the perpendicular distance from the grade nearest the house to the highest point of the roof but shall not include as part of the roof any cornice or bulkhead less than eight feet high, or any elevator enclosure less than sixteen feet high. Where such street grade varies, the mean or average grade thereof opposite such house shall be the datum from which such height shall be measured.

***439. Distance Between Buildings.)** No existing tenement house shall hereafter be enlarged or its lot be diminished, so that the rear line of any building on such lot approaches nearer than ten feet to the rear line of the lot, unless the rear of the lot upon which it stands, abuts upon a public alley, in which case the rear line of such building shall be not less than sixteen feet from the opposite side of such alley. Where a tenement house, now existing or hereafter erected, stands upon a lot other than a corner lot, no other building shall hereafter be placed upon the front or rear of that lot, unless the minimum distance between such buildings be at least ten feet, if neither building exceeds the height of one story; or fifteen feet, if either building exceeds the height of one story, but not the height of two stories, and so on, five additional feet to be added to such minimum distance of ten feet for every story more than one, in the height of the highest building on such lot: *Provided, that a one-story building without basement, and not used for habitation, may be placed on the rear of a lot containing a tenement house, if a minimum distance of ten feet is maintained between every point of such building and the tenement house.*

**Amended March 18, 1913.*

440. Percentage of Area Allowed to be Covered.) No existing tenement house shall hereafter be enlarged nor its lot be diminished, nor other buildings be placed on its lot, nor a tenement house be moved on a lot on which there is an existing building, so that after such change a larger proportion of any corner lot or other lot upon which it is situated is covered by buildings, than the following proportions, respectively: No new tenement house alone or with other buildings now or hereafter erected, shall occupy above the first story more than eighty-five per centum of the area of a corner lot, provided that in the case of a fireproof building, in which the windows of every habitable room open directly on a street, the portion of the lot covered may be ninety per centum of the area of said lot, subject to the requirement that a ten foot space must be left above the first story opposite the lesser frontage; or more than ninety per centum of the area of such corner lot if such corner lot is bounded on at least three sides by streets or alleys; or more than seventy-five per centum of the area of any other lot, provided that the space occupied by fire escapes, constructed and erected according to law and not more than four feet wide, shall be deemed unoccupied. Provided, however, that in case of a lot, triangular or irregular in shape bounded on two or more sides by a street and having a number of lineal feet street frontage exceeding one-twentieth of the number of square feet in the area of such lot, it shall not be necessary to comply with the conditions of this section as to percentage of lot which may be covered.

441. Must Have Alley or Yard in Rear—Size of Yard Increased.) At the rear of every lot containing a tenement house, there shall be a yard open and unobstructed from the earth to the sky, except by fire escapes not more than four feet wide, constructed and erected according to law, unless the

rear of such lot abuts upon a public alley at least ten feet wide, in which case the rear line of such building shall be not less than 16 feet from the opposite side of such alley; every part of such yard shall be directly accessible from every other part thereof; such yard shall have an area of at least eight per centum of the superficial area of the lot on corner lots except as otherwise provided in this section; and on other lots, such yards shall have an area of at least ten per centum of the superficial area of the lot. Every such yard shall be increased one per centum of the superficial area of the lot for every story above three stories in height of the tenement house situated thereon.

***442. Courts—Inner—Outer—Lot Line.)**

(a) "Inner courts" of all new tenement houses as defined in Section 432 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Courts—	Least width	Least area
Height of	in feet.	in square feet.
1 story	6.....	100
2 stories	6.....	120
3 stories	8.....	160
4 stories	8.....	160
5 stories	12.....	260
6 stories	16.....	400
7 stories	20.....	625
8 stories or more.	24.....	840

(b) The height of a court shall be the number of stories having habitable rooms with windows in its walls.

(c) "Outer courts" and "lot line courts" of all new tenement houses as defined in Section 432 of this chapter shall have minimum widths at every point equal to one-half of the minimum widths required by this section, and lot line courts shall have minimum areas equal to one-half of the minimum areas required herein for "inner courts." *If an outer court or lot line court has windows on opposite sides, its minimum width shall conform to the width given in the table.*

**Amended October 13, 1913.*

(d) The minimum widths hereinbefore specified for outer courts and the minimum widths and areas specified for lot line courts are to be provided irrespective of the presence of or dimensions of courts on other premises bounded by the same lot line.

(e) Every "inner court" and every "lot line court" of every new tenement shall be connected directly with a street, alley, yard, or outer court by an opening extending from grade at the building to a height of at least fifteen feet, and kept unobstructed save by an openwork grill or gate, such opening to be at least two feet wide for an inner court and one foot wide for a lot line court. In case of a three-story tenement on a lot twenty-five feet or less in width, a continuous lot line passage open to the sky, and six inches in width, shall be accepted for the opening specified above as one foot wide for a lot line court. If such inner court or lot line court starts from any point above finished grade at building, such starting point shall be considered as grade for purpose of determining the location of the opening to outer air herein specified.

(f) *In case of a three-story tenement on a lot twenty-five feet or less in width a continuous lot line passage open to the sky, and at least three feet wide, shall be accepted in lieu of a lot line court or outer court hereinbefore specified in Paragraph (a). In case of a three-story tenement on a lot thirty feet or less in width, a continuous lot line passage open to the sky, and at least three feet six inches wide shall be accepted in lieu of a lot line court or outer court hereinbefore specified in Paragraph (a).*

**Amended March 20, 1911.*

(g) In case of a two-story tenement on a lot twenty-five feet or less in width, a

lot line court having an area of at least fifty square feet shall be accepted in lieu of a lot line court heretofore specified in Paragraph (a) of this section, and in case of a three-story tenement on a lot of twenty-five feet or less in width, a lot line court having an area of at least sixty square feet shall be accepted in lieu of a lot line court heretofore specified and required by Paragraph (a) of this section.

(b) In case of two or three-story tenement buildings on lots twenty-five feet or less in width, where there is only one apartment on each story containing not more than four rooms in such apartment, the light courts hereinbefore specified in Paragraph (a) may be omitted, provided there is a continuous passageway open to the sky and not less than three feet wide on one side of said building.

443. Vent Shaft—Area Of.) (a) "Vent shafts" of all new tenement houses, as defined in Section 451 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Vent shafts Height of	Least width in feet	Least area in square feet.
1 story	3	21
2 stories	3	22½
3 stories	3	27
4 stories	3	36
5 stories	5	48
6 stories	6	72
7 stories	8	96
8 stories or more	8	120

(b) Every such vent shaft in every new tenement house more than two stories high, shall be connected directly with a street, alley, yard or court by one or more horizontal ducts or intakes at a level not lower than the finished grade of building nor higher than second story floor; the total area of such ducts to be not less than three per cent of the area of such vent shaft, and no single duct to be of less area than one hundred square inches; such total and individual duct area shall be net over and above all obstructions.

444. Stair Hall and Shaft—Well-Hole Dimensions.) (a) Every public stair hall in every new tenement house shall, for each story, have a window of an area of at least twelve square feet, opening directly on a street, alley, yard or court; or on a shaft of minimum area, as hereinafter provided; or shall have an unobstructed vertical well-hole of the following minimum area at each floor line above the first, and, directly over such well-hole, there shall be a skylight of twice the following minimum area:

Building— Height of	Least area in square feet of stair shaft or well hole.
2 stories—if there is more than one apartment on a floor	8
3 stories—if there is more than one apartment on a floor	13
4 stories	19
5 stories	25
6 stories or more	38

(b) Such window, if any, shall be so placed that light may pass directly to the opposite end of the hall, or else there shall be at least one window opening directly upon a street, alley, yard or court in every twenty feet in length or fraction thereof of such hall, except in so much of any entrance hall as lies between the entrance and the flight of stairs nearest the entrance, in any such public hall, recesses or returns, the length of which does not exceed twice the width of the hall, will be permitted, without an additional window, but, otherwise, each recess or return shall be regarded for the purposes of this section as if it were a separate hall. Any part of a public

hall which is shut off from any other part by a door or doors shall be deemed a separate public hall within the meaning of this section.

(c) Skylights shall be ventilating skylights and shall have over them a wire netting mounted on wire frame and 6-inch iron legs, of wire not lighter than No. 12 and with mesh not coarser than one inch by one inch, unless constructed of wired glass or prismatic light glass.

445. Rooms—Sizes and Height Of—Attic Rooms.) (a) In every new tenement house, all habitable rooms shall be of the following minimum sizes:

(b) In each apartment, there shall be at least one room containing not less than one hundred twenty square feet of floor area, and every other room shall contain at least eighty square feet of floor area, provided, however, that in the case of a room having a window not less than eighteen feet in area opening upon a public street, the floor area need not be greater than seventy feet. Each room shall be in every part not less than eight feet six inches high from the finished floor to the finished ceiling; provided, however, an attic room need be eight feet six inches high in but one-half of its area, provided there are not less than 750 cubic feet of air space therein.

446. Alcoves and Alcove Rooms.) (a) For the purpose of buildings of Classes III and IV, an alcove shall be defined as a recess connected with or at the side of a larger room. The floor of such an alcove shall be counted as a part of the floor area and its cubic contents as a part of the cubic contents of the room with which it is connected.

(b) In every new tenement house every alcove shall be deemed a separate room for all purposes within the meaning of this chapter, except an alcove that has a floor area of not to exceed thirty-five square feet and that has an unobstructed opening, equal in area to twenty per centum of its entire wall surface, into an adjoining habitable room; provided that in constructing additional habitable rooms by raising or altering existing one story dwellings, the limitation of the floor area of an alcove may be disregarded, provided such alcove has an unobstructed opening, equal to the floor area of such alcove, into an adjoining habitable room.

(c) This section shall not be construed as forbidding the erection of pilasters or other decorative effects projecting not more than eighteen inches from the plane of the wall of a habitable room.

(d) No part of any room in a tenement house shall be enclosed or sub-divided at any time, wholly or in part, by a curtain, portiere, fixed or movable partition or other contrivances or device, unless each part of the room so enclosed or sub-divided shall contain a separate window as herein required, and shall have a floor area of not less than 80 square feet as herein required for habitable rooms, except as heretofore provided in this section.

447. Air—Quantity of for Each Person.) No room in any tenement house shall be occupied so that the allowance of air to each adult person living or sleeping in such room shall at any time be less than four hundred cubic feet or less than two hundred cubic feet for each person under twelve years of age.

448. Habitable Rooms—Bath Rooms—Pantries—Requirement as to Ventilation and Lighting.) (a) In every new tenement house every habitable room shall have a window or windows with a total glass

area equal to at least one-tenth of its floor area opening onto a street, alley, yard or court. None of such required windows shall have a glass area of less than ten square feet, and each such window shall have its top not less than seven feet above the floor and shall be so constructed that at least its upper half may be opened its full width.

(b) In every new tenement house every bath room, water closet, or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of one foot, opening upon a street, alley, yard, court or vent shaft.

(c) In every new tenement house every pantry shall have at least one window of not less than six square feet in area, with a width of not less than one foot, opening into a street, alley, yard, court or vent shaft, which vent shaft shall be at least six square feet in area.

***449. New Tenements—Habitable Rooms in Basements—Prohibited in Cellars.)** In no new tenement house shall any room in the cellar be constructed, altered, converted or occupied for living purposes; and no room in the basement of a new tenement house shall be constructed, altered, converted or occupied for living purposes unless such rooms shall be at least eight feet six inches high in the clear and shall have at least one-half of such height above the finished grade of said premises at the building, and at least four feet three inches of such height above the average street grade at the building. "Provided that only (1) living apartment not exceeding six (6) rooms shall be allowed in the basement of any tenement house hereafter to be constructed."

*Amended February 8, 1915.

450. Tenement Houses—Requirements for Fireproof and Slow-burning Construction.) Every new tenement house more than five stories and basement high shall be of fireproof construction. Every new tenement house more than three stories and basement high, but not more than five stories and basement high shall be of slow-burning or fireproof construction. In case slow-burning construction be required, the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

***451. Frame Tenement—Requirements.)**

In every new frame tenement house outside the fire limits, each suite of apartments shall be separated from the next suite in such building by a partition of four-inch tile or of metal studding and metal lath, and the enclosing walls around the stairs, where there are two or more apartments on a floor, shall be of fireproof construction or of solid masonry of the same dimensions as are required by Section 510.

*Amended February 20, 1911.

***452. Frame Additions to Frame Tenement Houses Within Fire Limits Not Permitted—Removal of Frame Tenement Houses.** No frame addition shall be permitted to any frame tenement house within the fire limits, either by adding to its height or its superficial area.

If a tenement house, standing on wooden supports, is moved to another lot, it shall not again be placed on wooden supports, but shall be placed on a masonry or concrete foundation.

If a frame tenement house, not more than two stories high, is moved from one location to another upon the same lot, it may be set upon wooden posts and a basement or cellar not to exceed six feet six inches in height from the floor to the ceiling thereof may be maintained thereunder, and no habitable rooms shall be constructed or occupied in said basement or cellar.

*Amended July 8, 1912.

453. Entrance Halls—Solid Masonry—Exceptions—Ceilings.) Every main entrance hall in a new tenement house shall be at

least three feet six inches wide in the clear from the entrance up to and including the stair enclosure and beyond this point at least three feet wide in the clear. In every new non-fireproof tenement house, except where there be only one apartment on each floor, such entrance hall shall be inclosed with solid masonry walls and with ceilings covered with incombustible material and shall comply with all the conditions of the following sections of this ordinance as to the construction of stair halls. If such main entrance is the only entrance to more than one flight of stairs, the several portions of such main entrance hall which separate the entrance of the building from the several flights of stairs, respectively, shall be increased respectively at least one foot in width for each additional flight of stairs.

***454. Stair Halls—Construction Of.)** (a)

The stairs and stair halls in all new tenement houses more than three stories and basement or cellar high shall be constructed of incombustible material throughout, except that the treads of stairs may be of wood not less than one and three-eighths inches thick and all handrails may be of hardwood.

(b) In every new non-fireproof tenement house all stair halls shall be enclosed on all sides with walls of solid masonry of the dimensions required by Section 519. All windows in stair halls, except where same open into a street, alley, outer court, or yard, shall have metal frames and sashes, glazed with wired glass. This section shall not apply to tenement houses which are not more than three stories and basement high with only one apartment on each floor. "Where the main entrance vestibule and entrance hall or corridor of said building, including the floor and ceiling thereof, are of fireproof construction as defined in this chapter, from the outside face of the building at said entrance to and including the floor of stair hall, and all doors leading therefrom or thereto except the street doors are fire retarding doors, the floor of said entrance and vestibule may be built at a level of two inches (2 in.) above the level of the outside grade of the building at the entrance of same, without changing the definition of the word "Basement" with regard to height of floors, as contained in Section 432 of The Chicago Code of 1911, as amended."

*Amended February 8, 1915.

***455. Apartments Divided by Masonry.)**

(a) There shall be a wall of solid masonry of thickness as required by Section 519, extending from the ground to the roof between each set of apartments and around each court and each light shaft, except as hereinafter provided; (a) provided, however, that a wall between apartments and extending from the main stair hall to the outer wall of the building may be offset at the second story floor line to some point nearer the center of the building, or of the group of apartments, to admit of an even distribution of space in the rooms adjacent to such wall, if such wall is supported at the second story floor line on fireproofed steel or iron beams which extend from the brick wall surrounding the main stair hall to the outer wall of the building; and provided, further, that such offset wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams carried by masonry walls as above specified; (b) and provided, however, that, in case there is a store or stores in the first story of a building of this class, a masonry dividing wall between apartments may begin at the second story floor line, if such dividing wall is supported on fireproofed steel or iron beams carried by masonry; and provided, further, that such dividing wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams carried by masonry. And provided that in buildings of fireproof construction the partitions between apartments, and around stairs may be of burnt clay tile not less

than three inches in thickness or re-inforced concrete partitions not less than three inches in thickness.

(b) In buildings of ordinary construction two separate thicknesses of metal lath and fire-resisting plaster shall be used as fireproofing as required by this section.

*Amended February 20, 1911.

456. Ceilings Over Stores—Courts and Shafts Beginning Above First Story.)

(a) In every new non-fireproof tenement house in which there is a store or stores in the first story, if the building is three stories or less in height, the portions of the first story ceiling directly under all public halls shall be of slow-burning construction, and if the building is four or more stories in height the entire basement and first story construction and the second story floor construction shall be of fireproof construction.

(b) In every new non-fireproof tenement house the masonry walls enclosing every court or light or vent shaft beginning above the first story shall be supported on fireproofed steel or iron beams carried by masonry or by fireproofed steel or iron columns; and such court or shaft enclosing walls may be reduced to the thickness of eight inches if supported at every intersecting floor line on fireproofed steel or iron beams carried as above specified.

457. Damp-Proofing—Basement Walls to Be Masonry—Cement Floor.) In every new tenement house constructed of brick or frame, the foundations and basement walls shall be built of masonry or concrete not less than twelve inches in thickness, except as provided in Section 519 and shall have all outside walls below the adjacent ground level plastered on the outside with Portland cement or treated with other approved damp-proofing material, and such walls, as high as the ground level, shall be laid in cement mortar. The basement or cellar of every existing and new tenement house shall have a floor of Portland cement concrete not less than three inches in thickness laid on not less than six inches of sand or chders.

***458. Bay Windows—Courts—Vent Shafts.)**

(a) The walls of every bay window and every court in masonry constructed new tenement houses shall be built of brick or other fireproof construction as required for exterior walls.

(b) The walls of every interior vent shaft in masonry constructed tenement houses shall be built of masonry or of fireproof material not less than four inches in thickness, supported by steel or iron.

*Amended February 20, 1911.

***459. Porches.)** (a) Where porches are constructed in courts of now existing or new tenement houses, the amount of area of unobstructed space in such courts shall be exclusive of space occupied by stairs and porches. No additional rear porch shall be constructed on any existing tenement house in such way that the buildings on the lot with all their porches shall occupy a greater proportion of the lot than is permitted in Section 440 of this chapter. No rear porch on any existing tenement house where the total area of buildings and all porches exceeds the proportion of the lot permitted in Section 440 of this chapter shall be reconstructed until the plan for such reconstruction shall have been submitted to and approved by the Commissioner of Buildings. No rear porch built of combustible materials and more than eight feet in width, excepting stairways, shall be constructed on any new tenement house nor added to, nor reconstructed on any existing tenement house.

(b) Front porches of buildings in existence at the time of the passage of this amendatory ordinance may be enclosed temporarily from the first

day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided that the glass area shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half of their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and the area of such open sash shall be at least twice the area of all windows from adjacent rooms opening on to porches so enclosed, unless such room adjoining said porch shall have windows opening on to a street, alley, yard or court of proper legal dimensions as required by this Chapter for habitable rooms in addition to the windows opening on to the porch, in which case the amount of movable sash in porch enclosure shall be not less than ten per cent of the floor area of said porch and in no case less than ten square feet of glass area.

(c) Rear porches and side porches of buildings in existence at the time of the passage of this amendatory ordinance, where every part of said porch is at least ten feet distant from any other building, porch or structure located upon the same lot with the building of which such porch is a part, may be enclosed temporarily from the first day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided, that the glass area of the enclosure shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and in no case shall be less than three times the area of all windows, doors and transoms opening on to said porch, and that in every case the top of the sash in such enclosure shall be at least six inches higher than the top of the windows and doors opening on to such porch. The framing of the porch enclosure may be of wood, and the glass area of each side and of each end of such porch shall be not less than fifty per cent of the entire side or end of such porch enclosure measured from the floor of the porch to the under side of joists immediately above such porch in each story.

(d) In every building erected after the passage of this amendatory ordinance, every front porch, rear porch or side porch which is intended to be enclosed must have enclosing walls as required by the ordinances of the city for enclosing walls of a building of the type of which said porch is a part, and every porch so enclosed shall be considered a separate habitable room and shall comply with all the requirements of this Chapter for habitable rooms, and such porch enclosure shall not in any manner intercept the light or the ventilation of any adjoining room.

*Amended March 2, 1914.

(e) Where buildings do not exceed three stories in height the stairways in rear porches may be partially enclosed as follows: the end of the porch outside the stairway, also the back of the porch around said stairway not to exceed eleven feet in extent, may be enclosed with wood or frame construction and a window with glass area of nine square feet shall be placed in the back enclosure or in that part of the porch facing the yard or court on each story.

Paragraph (e) added February 19, 1915.

***460. Flues and Chimneys.)** In every building used for the purposes of Class VI, the flues or chimneys shall conform to the following regulations: For one store opening, the flue area shall not be less than forty-nine square inches. For more than one store opening and one furnace opening, the flue area shall not be less than seventy-seven square inches. All such flues shall be constructed according to the requirements of Section 581 of this chapter.

*Amended February 20, 1911.

461. Bulkhead in Roof—Construction of—When Required.) There shall be in the roof of every new tenement house, unless the pitch of the roof thereof exceeds one foot rise in four foot run, at least one bulk-

head or scuttle, fireproof or covered with fireproof material, with stairs or ladder leading thereto; no such roof opening shall be less than two feet by three feet. Where such tenement house is provided with rear stairs, there shall be a bulkhead or scuttle accessible from each of such rear stairs. No scuttle or bulkhead door shall have any lock on it but may be fastened on the inside by movable bolts or hooks.

***462. Stairways—Width and Construction of.)** (a) Every now existing and every new tenement house shall have at least two flights of stairs, which shall extend from the entrance floor to the top story, and which stairs shall be as far apart as practicable. One of said stairways shall be an interior stairway. Such stairs and the public halls in every tenement house shall each be at least three feet wide in the clear, and every apartment shall be directly accessible from both such flights of stairs without going through any other apartment. An apartment whose gross floor area does not exceed 1,000 square feet and having not to exceed six habitable rooms in an existing tenement house and which at the time of the passage of this ordinance had not access to two stairways, may have exit to a second stairway through another apartment, providing the door between the two apartments is equipped with a glass panel not less than five feet high and twenty inches wide, with the bottom of same not less than eighteen inches above the floor. Or where the floor level of said apartment is not more than twelve feet above the surface of the yard or ground surrounding the building, a balcony with an area not less than eighteen square feet equipped with a drop ladder to the ground may be attached to the outside wall of said building accessible by a door or window from such apartment and may be considered as a secondary means of exit from said apartment, if in the judgment of the Commissioner of Buildings such glass panel door, balcony and ladder will afford safe means of exit for any such apartment. Where halls or stairs in an existing tenement house have been damaged by fire or otherwise to an extent greater than one-half the value thereof, such halls or stairs so damaged shall be repaired so as to conform to the requirements of this chapter with regard to halls and stairways relating to new tenement houses.

***Amended February 20, 1911.**

Par. (a) again amended June 30, 1916.

(b) All enclosed stairs in every tenement house shall have at least one handrail, and where the width of such stairs is greater than 3 feet 6 inches, such stairs shall have a handrail on each side thereof. All open stairs shall be provided with suitable and substantial handrails on each side.

463. Stairs in Non-Fireproof Buildings, Eighty or More Rooms.) Every new non-fireproof tenement house containing over eighty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional eighty rooms, or fraction thereof; but if such building contains not more than one hundred and twenty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building shall be at least one-half wider than is provided in this chapter.

464. Stairs in Fireproof Buildings, One Hundred and Twenty Rooms and Upward.) Every new fireproof tenement house containing over one hundred and twenty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional one hundred and twenty rooms or fraction thereof; but if such building contains not more than one hundred and eighty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building may be made at least one-half wider than is provided in this chapter.

465. Stairs—Entrance to—Treads and Risers.) Every flight of stairs required in a tenement house shall have an entrance on the entrance floor from a street or alley, or from a yard or court which opens into a street or alley. All stairs except rear stairs, in new tenement houses, shall have risers not more than seven and three-quarters inches high and treads not less than nine and one-half inches wide exclusive of nosings, except in winding stairs, where all treads at a point eighteen inches from the strings on the well side shall be at least nine and one-half inches wide, exclusive of nosings.

466. Fire Escapes.) Every tenement house four or more stories in height shall be provided with a fire escape or fire escapes, such as are required by this chapter. In every case each separate apartment shall have direct access to at least one such fire escape unless such apartment shall have direct access, without passing through any other apartment, to at least two separate flights of stairs leading to the ground, one of which is placed in front and one in the rear of such building, and one of which may be placed outside of the building; but where such separate apartment shall not have access to two such flights of stairs, then such apartment shall have direct access to a stairway fire escape. Every court in which there is a fire escape shall have direct and unobstructed access along the surface of the ground to a street or alley or to yard opening into an alley or street without entering into or passing through or over any building unless by a four foot wide fireproof passage on the court or ground level. Except as herein specifically provided, the number, location, material and construction of fire escapes shall be controlled by the general provisions of this chapter on fire escapes.

467. Stairways and Fire Escapes to Be Free From Obstruction.) No obstruction of any kind shall at any time be placed before, upon or against any stairway, steps or landings or fire escapes in or upon any tenement house. All fire escapes upon tenement houses shall be kept in good order and repair, and every exposed part thereof shall at all times be protected against rust by durable paint.

468. Shafts, Courts, Yards, Graded—Concrete—Drained.) In every now existing and new tenement house, the bottom of all shafts, courts or yards shall be provided with sanitary drainage and shall be graded or paved.

469. Access to Rooms—Otherwise than Through Bedroom.) In each apartment in every new tenement house, access to every living room and bedroom, and to at least one water closet compartment shall be had without passing through any bedroom.

470. Water Closets—Windows in—Artificial Light.) (a) In every new tenement house there shall be a separate water closet in a separate compartment within each apartment, except that where there are apartments consisting of only one or two rooms, in which case there shall be at least one water closet for every two apartments.

(b) Every water closet compartment in every existing tenement house shall be ventilated by such a window, or else by a vent shaft of at least one-half the minimum area required in Section 443. Every water closet compartment in every tenement house shall be provided with proper means of artificially lighting the same. If fixtures for gas or electricity are not provided in any such compartment, then the door thereof shall have ground glass panels or transoms.

471. Sinks—Requirements.) In every new tenement house there shall be in each

apartment at least one kitchen sink with running water. In every existing tenement if there be not one such sink in each apartment there shall be on every floor at least one kitchen sink with running water, accessible to all the tenants of the floor, without passing through any other apartment. In no tenement house shall there be wood-work inclosing sinks; the space underneath sinks shall be left entirely open.

472. Pipes Through Floors—Catch Basins—Water Closets.) (a) In every new tenement house where plumbing or other pipes pass through floors or partitions, the openings around such pipes shall be sealed tight with plaster or other incombustible material, so as to prevent the passage of air or the spread of fire from one floor to another or from room to room.

(b) In the premises of a tenement house the catchbasin shall, whenever practicable, be placed in a court or yard, and shall be covered with a stone or iron cover, flush with the surface so that access to such basin shall be convenient.

(c) Where it is for any reason impracticable to place a catchbasin in a court or yard, the Commissioner of Health may authorize the use of an iron catchbasin with air-tight cover, located in the cellar or basement.

472½. Buildings Damaged by Fire, Etc.) If any existing tenement house is hereafter damaged by fire or other cause, including ordinary wear, so that at any time its value be less than one-half its original value exclusive of the value of the foundations, such building shall not be repaired or rebuilt except in conformity with the provisions of this ordinance applicable to new tenement houses.

473. Provisions of this Article Not to Apply to Existing Buildings, Except Under Certain Circumstances—Then Commissioner to Notify.) (a) Nothing in this Article contained shall be construed as requiring alterations in the construction or equipment of buildings in existence at the time of the passage of this Article and which at the time of their construction were built in compliance with the ordinances then in force, unless they are in conflict with the requirements of Sections 447, 466, 471, 475, 476, 477, 468, or unless such buildings shall not have sufficient or adequate means of egress therefrom, by reason of insufficient or inadequate stairways, improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress.

(b) Where it shall appear to the Commissioner of Buildings that any such building has insufficient means of egress therefrom as aforesaid, he shall notify the owner, agent or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building, as are necessary to be made in order to promote the safety of the occupants of such building and of persons using the same and of the public.

474. Rooms and Halls—Additional.) Every room or hall that may hereafter be constructed or created in an existing tenement house shall comply in all respects with the provisions of this ordinance as to size, arrangement, light and ventilation of rooms and halls.

475. Rooms—Change in Existing.) No room in any now existing tenement house shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a window having a superficial area not less than one-twelfth of the floor area of the room, which window shall open upon a street or alley or upon a yard

or court having a superficial area of not less than twenty-five square feet and a minimum width of not less than two feet six inches, or unless such room adjoins another room in the same apartment, which other room shall have such a window opening upon such a street, alley, yard or court, between which two adjoining rooms there shall be an alcove opening equal in extent to at least 20 per cent of the entire wall surface of said room, provided, however, that all of the requirements of Sections 439 and 440 of The Chicago Code of 1911 shall be complied with.

Where a frame tenement house is moved from one lot to another, or from one location to another on the same lot, it shall comply with the provisions of Section 452 of this Chapter.

*Amended July 8, 1912.

476. Windows—Courts—Attic.) No room in any now existing tenement house, which has no such window as aforesaid, opening upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet, shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a floor area of at least sixty square feet and also at least six hundred cubic feet of air space; nor unless every part of the finished ceiling of such room be at least seven feet six inches distant from every part of the finished floor thereof; provided, that an attic room need be seven feet six inches high in but one-half of its area, and, provided, further, that such attic room has not less than seven hundred fifty cubic feet of air space therein; and such attic room shall not be used for purposes of human habitation other than as a sleeping room.

477. Existing Tenements—Living Rooms in Cellars or Basements—When Permitted.)

(a) In every existing tenement house, no room in an existing cellar or basement shall be occupied for living purposes unless such room shall be at least seven feet six inches high in the clear, and have not more than four feet eight inches of such cellar or basement below the finished grade at building; provided that no such room shall be used for living purposes unless such room shall have a window opening upon a street, alley, yard or court, and, provided, that when the windows of any living room front solely upon a street and the floor of such basement is four feet eight inches below the sidewalk grade, such windows shall be located not less than three feet back of the lot line; provided, however, that in every case where the height of ceiling of any living room is less than eight feet six inches in the clear, the window area of such room shall be at least 15 per centum of the floor area.

(b) When a brick or frame tenement house is moved from one lot to another, or from one location to another on the same lot and a basement or story or both, is constructed under the same, the total height of which is more than six feet six inches from the floor to the ceiling, the walls of such basement shall be constructed of masonry according to the provisions of Section 658 of The Chicago Code of 1911, and the habitable rooms therein shall comply with the provisions of Section 475 of The Chicago Code of 1911, and the space on the lot shall comply with the provisions of Section 430 and Section 440 of The Chicago Code of 1911.

*Amended July 8, 1912.

477½. Insanitary Conditions—Nuisance.)

A tenement house or part thereof which is in an insanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water or by reason of the presence of sewer gas, or by reason of any portion of such building being infected with disease, or being unfit for human habitation, or which by reason of any other insanitary condition is a source of producing sickness among the inhabitants of this city, or which in any way endan-

gers the public health, is hereby declared to constitute a public nuisance.

ARTICLE X.

Class VII.

478. **Class VII Defined.)** In Class VII shall be included every building used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as a department store.

478½. **Must Comply With General and Special Provisions.)** Every building of Class VII shall comply with the general provisions of this chapter, and, in addition to the general provisions, shall comply with the following special provisions:

479. **Buildings of Class VII—Construction of.)** Buildings three stories or less in height, used either wholly or in part for the purpose of Class VII, may be of ordinary construction. Such buildings more than three and not exceeding five stories in height shall be of slow-burning, mill or fireproof construction. Such buildings over five stories in height shall be of fireproof construction.

480. **Stores Used for Retail Sale of Goods or Manufacturing Purposes—Occupation of Basement—Lockers.)** (a) Not more than the lower twelve stories above the street grade shall be used for the retail sale of goods, or for locker provisions in excess of accommodations for the number of employees on the floor on which they are employed, or for manufacturing purposes in a building devoted wholly or in part to purposes of Class VII except as hereinafter provided; provided, however, the stories above the twelfth story may be used for these or other purposes when equipped with an approved automatic sprinkler system approved by the Fire Marshal; and further provided, that all such buildings hereafter erected to be used for these purposes, or so used, above the twelfth story shall in addition to being equipped with an approved automatic sprinkling system have enclosed stairways.

(b) Not more than one floor of any basement or cellar shall be used for the retail sale of goods. Such floor shall be the nearest to the inside street grade. Such floor used for the retail sale of goods shall not be more than twenty feet below the inside street grade.

(c) No sub-basement, cellar or part of a basement below such floor shall be used for the sale of any goods in any manner, but locker and dressing rooms may be placed in the sub-basement, provided the space thus occupied be separated from the remainder of the basement by fireproof partitions, and that there be at least two flights of stairs placed as far apart as practicable leading therefrom to the first floor, inclosed in fireproof partitions. Such stairs from such locker or dressing rooms shall be, in addition to other stairways required by this chapter for such buildings, and at least one of such stairways shall open directly on a street, alley or court opening on a street or alley, or on a fireproof passage leading to the street, alley or such court. Where more than five lockers are in one room, such lockers shall be of incombustible material.

(d) Where stories above the twelfth story are used for the purposes of Class VII as hereinbefore described for locker provisions in excess of accommodations for employees on the floor on which they are employed, then the stairways from the first to the topmost floor shall be built and inclosed as described in Section 663, but the stairways shall be in number and aggregate width as required in the table for stairways set forth in Section 666 of this chapter.

481. **Floor Areas—Maximum.)** (a) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of ordinary construction shall not exceed nine thousand square feet.

(b) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of slow-burning or mill construction shall not exceed twelve thousand square feet.

(c) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of fireproof construction shall not exceed 25,000 square feet, unless the building is completely equipped with an approved automatic sprinkler system, but in no case shall such area exceed 30,000 square feet.

482. **Floor Areas—Exceeding the Maximum Limits Defined in Section 481.)** (a) Where any floor or portion of a floor used for the purposes of Class VII in any building shall exceed in area the maximum number of square feet allowed in the preceding section for the type of construction of such building in which such floor is contained, each such maximum amount of floor area so used shall be separated from other parts of such floor by fire walls, or dividing walls built in accordance with the provisions of Section 250 of this chapter relating to dividing walls in buildings of Class I.

(b) Where any such floor so used is divided by such fire walls or dividing walls, each such division of such floor shall be provided with stairs, aisles, exits, and fire escapes as required in this chapter for separate and distinct buildings, and each such division shall be considered as a separate building, except as provided in Section 508 of this chapter.

483. **Galleries.)** (a) The area of any or all of the galleries, mezzanine or intermediate floors in any one story used wholly or in part for the purposes of Class VII in any building shall not exceed ten per centum of the area of such story. Galleries, mezzanine or intermediate floors of a larger size than the above shall be considered as full stories.

(b) Every gallery, mezzanine or intermediate floor shall have at least one stairway not less than three feet wide.

(c) The height from the floor of any gallery, mezzanine or intermediate floor to the ceiling over same shall not be less than seven feet, and there shall be not less than seven feet of space between the bottom of such gallery, mezzanine or intermediate floor and the floor of the story in which such gallery, mezzanine or intermediate floor is placed.

(d) Every gallery, mezzanine or intermediate floor in any building used for the purposes of Class VII shall be built to conform to the construction applicable to such building, but galleries not exceeding five per centum of the area of such story, may be built of incombustible material without fireproof protection.

(e) No gallery, mezzanine or intermediate floor shall be built without a permit from the Department of Buildings, and plans showing the construction and size of such proposed gallery, mezzanine or intermediate floor shall be filed with the Department of Buildings when a permit is applied for.

484. **Courts of Class VII Buildings.)** (a) Every court or light shaft of every building used wholly or in part for the purposes of Class VII shall be open and unobstructed from the bottom of such court to the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is

required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

(b) All windows, doors or other openings in court walls of such buildings shall have metal frames, metal sashes and metal doors, with the glazed portions thereon of wired glass.

485. Stories—Number of.) The first story above the inside street grade shall be designated and known as the first story for all purposes of this chapter, and the stories above shall be numbered consecutively, the second, third, and so on.

486. Stairs—Halls—Passageways and Aisles—Signs and Lights.) (a) The stair halls, passageways and stair aisles shall be unobstructed and be as wide as the stair and not less than four feet wide in the clear.

(b) The exit door or doors between floors and stair halls shall be not less than ninety per centum of the width of the stairway to which they afford access, and for each elevator opening into such a stair hall, the doors to floors shall be increased six inches in width.

(c) The stairways and stair halls of any building used wholly or in part for the purpose of Class VII shall be illuminated by gas or electric light, and the gas piping and the electric wiring shall be accomplished by piping and circuits separated and distinct from the general illuminating piping and circuits of the premises. Each stair light shall have a red glass inclosure.

(d) At the bottom of each such stairway there shall be an illuminated red glass sign with the number of the story in which it is situated inscribed thereon in letters not less than six inches high.

487. Aisles in Class VII Buildings.) (a) In buildings used wholly or in part for the purposes of Class VII there shall be aisles in such portions of the buildings as are used for such purposes, connecting the stairways and the elevators directly with the street or alley doors, and such aisles shall be termed "main aisles." Such main aisles shall have a clear width equal to the width of the stairways connecting therewith, and for each elevator connecting with such an aisle there shall be an additional width of six inches, and no such main aisle shall be less than five feet wide in the clear between the counters in any department store or between the fixed seats therein. One-third the width of any basement stairway shall be added to the width of the main aisle connecting with such stairway.

(b) If there is a column in any such aisle, then the width of the aisle shall be increased by the width of such column.

(c) If there is a counter, or counters, or settee, or any case, or other obstruction in an aisle, then that part of the aisle on each side of such counter, bench or case, or other obstruction shall be considered as a separate aisle. No aisle shall be less than three feet in width.

488. Exit Signs and Lights.) (a) All exits in buildings used wholly or in part for the purposes of Class VII shall be clearly indicated by illuminated red signs with the word "Exit" thereon in letters not less than six inches high. At the bottom of each stairway on the street floor level there shall be similar signs indicating the direction of the nearest exit to a street or alley.

(b) Fire escape doors or windows shall be indicated by illuminated red signs with the words "Fire Escape" thereon in letters not less than six inches high.

***489. Doors at Street Level—Revolving Doors.)** The clear width of the exit openings

shall be computed in the same manner as that provided in this article for main aisles, and no door openings shall be less than five feet wide, and all doors shall swing outward. Revolving doors shall not be considered as complying with this section unless the revolving wings of such revolving doors are so arranged that by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said doors fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed, and all deficiency of required exits must be made up by additional doors.

*Amended February 20, 1911.

490. Doors in Dividing Walls.) (a) Door openings may be built in dividing walls of such buildings; provided, however, that such door openings shall be not less than five feet in width and shall be provided with fire-proof doors built as described in Section 573 of this chapter, and that each door shall have an efficient closing device which will operate automatically in the event of a fire in close proximity to either side of such door.

(b) Each such opening shall have exit signs and lights as provided for street doors and exit signs in Section 488 of this chapter. There shall be aisles not less than five feet in width connecting with such doors from the main aisles, and in no case shall any such door be less than ninety per centum of the width of the aisle directly connecting therewith.

491. Loads—Allowance for Live Loads in Construction of Floors of Buildings of Class VII.) For all buildings of Class VII the floor shall be designed and constructed in such a manner as to be capable of supporting, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors, and shall be figured in accordance with Section 516 of this chapter.

ARTICLE XI.

Class VIII.

***492. Class VIII Defined—Provisions of.)** In Class VIII shall be included every building used for school purposes and every building containing class rooms for special or general instruction, other than halls for the purpose of instruction as included in Class IV, where such building so used shall have a seating capacity of more than fifty students.

*Amended May 17, 1915.

492½. Must Comply With General and Special Provisions.) All buildings of Class VIII shall comply with the general provisions of this chapter wherever the same are applicable thereto, and in addition to the general provisions shall comply with the following special provisions:

493. Construction of.) (a) All buildings hereafter erected and used or intended to be used wholly for the purposes of Class VIII shall be constructed in accordance with the provisions of this chapter relating to Class VIII; and existing school buildings shall comply with the provisions of Class VIII with reference to stairs, exits and fire escapes.

(b) Buildings which have a seating capacity of two hundred or less and which are not over two stories and basement in height, may be built of ordinary construction; provided, that no portion of such building shall be used for assembly hall purposes.

(c) Buildings which have a greater seating capacity than two hundred and not exceeding four hundred, and which are not over three stories and basement in height, shall be built of slow-burning or fireproof construction.

(d) Buildings which have a greater seating capacity than four hundred, or which are more than three stories and basement in height, shall be built entirely of fireproof construction.

(e) Additions to existing buildings shall be built of the several types of construction required by this section; provided, however, that the sum total of the seating capacity of the entire building, including additions, shall be counted in determining the type of construction required for such addition.

(f) All alterations in existing buildings used for the purposes of Class VIII, other than new additions thereto, and intended to make them comply with the requirements of this chapter, may be executed in the same kinds of materials originally used in such buildings, unless otherwise distinctly provided herein.

494. Walls—Window Openings in.) No wall of any building used for the purposes of Class VIII and containing a window opening shall be nearer than five feet to any lot line of adjoining property, street and alley lines not included.

495. Portable Frame Buildings.) Portable frame buildings used wholly for the purposes of Class VIII, not larger than 28 by 36 feet and not over one story high, may be erected, provided exterior walls and roof of same are covered with metal or other incombustible material, and the interior woodwork painted with fire-retarding paint approved by the Commissioner of Buildings; and, provided, further, that the location of such buildings shall be approved by the Commissioner of Buildings. Such portable buildings shall not be located nearer than ten feet to any other building, and shall not be maintained on any one lot or block for a longer period than two years after the date of the issuance of the original permit.

496. Assembly Halls—Limitations as to Seating Capacity and Floor Level.) (a) The limit of height at floor level and the maximum seating capacity of assembly halls or auditoriums or other single rooms in buildings of this Class must not exceed the numbers given in the following table, for the specified type of construction, to-wit:

Floor— Height of Above Grade.	Type of Construction— Slow burning or Mill Construction Having Fireproof		
	Fireproof Construction.	Stairs and Corridors.	Ordinary Construc- tion.
Persons. Persons. Persons.			
Over 60 ft.	500	100	...
60 ft. or less..	600	300	...
45 ft. or less..	700	500	...
30 ft. or less..	1000	800	250
20 ft. or less..	1500	900	500
10 ft. or less..	2000	1000	800
5 ft. or less..	2500	1200	1000

(b) All assembly halls or other single rooms having a seating capacity larger than that given in the above table must have the highest part of the main floor within not more than one foot of grade level and must have exits leading directly to three streets, public alleys, or to open public grounds.

(c) Seating capacity of all assembly halls in buildings of this Class shall include the

total aggregate seating capacity of all balconies, galleries, stages and platforms as well as the main portion of such assembly hall or rooms.

(d) Heights of assembly hall floors shall be measured from sidewalk level at entrance of building or open school grounds to highest part of main floor of such assembly hall or rooms.

497. Stairways—Width of.) (a) Stairways in buildings used for the purposes of Class VIII shall be equivalent in width to fifteen inches for every hundred of seating capacity in such building as measured by the aggregate seating capacity of the auditorium, assembly rooms and school rooms; provided, however, that the number of persons allowed in such buildings at any one time shall be limited by the width of stairways available as exits therefrom.

(b) No stairway shall be less than four feet in the clear, except where more than two stairways lead down from any floor, in which case stairways three feet in width in the clear may be counted in the total width of stairs required.

(c) Where two or more stairways are used, they shall be placed at opposite ends of the building or as far apart as practicable, and all such buildings hereafter erected shall have at least two separate and distinct stairways from the ground floor to the top floor, and all existing buildings shall have two such separate and distinct stairways, or one stairway and one sliding or stairway fire escape.

(d) All stairways shall have railings on each side thereof. No stairway shall ascend a greater height than thirteen feet six inches without a level landing, the dimensions of which, in the direction of the run of the stairs, shall be not less than four feet, or which, if at a turn of the stairs, shall be of not less width than the width of the stairs. No winder shall be permitted in any stairs. Stairways which are over nine feet wide shall have double intermediate handrails with end newel posts at least five and one-half feet high. All stairways shall discharge at the bottom directly to a public thoroughfare or open ground.

498. Stairways in Buildings Hereafter Erected—Fireproof.) In buildings hereafter erected more than two stories and basement in height, the stairways and their enclosing walls shall be of fireproof construction.

499. Width of Corridors, Passageways, Hallways and Doorways.) The width of corridors, passageways, hallways and doorways shall be equivalent in width to eighteen inches for every one hundred of seating capacity of such portions of building as will be required to use same for exit. No corridor, passageway or hallway shall be less than five feet in width, and no doorway less than three feet in width, except where two or more doors, each two feet eight inches or more in width, are grouped together.

500. Doors to Open Outward—Covering of.) All doors in such buildings shall open outward, and all entrance and exit doors shall be unlocked at all times when the building is occupied for school purposes, or open to the public. All exit doors from assembly halls to other parts of the building shall be covered with metal or other fireproof material approved by the Commissioner of Buildings.

501. Aisles—Width of—In Assembly Halls and Recitation and Study Rooms Must Be Kept Clear of Obstructions.) (a) Aisles in Assembly halls in such buildings shall be equivalent in width to eighteen inches for every one hundred of seating capacity in such assembly hall, but no such aisle shall be less than two feet six inches wide in its

narrowest part. All groups of seats shall be so arranged that they shall have an aisle on each side, and not more than twelve seats in any one row shall be placed between aisles.

(b) Aisles in class rooms, recitation rooms and study rooms of such buildings shall be equivalent in width to eighteen inches for every one hundred permanent seats in any such room, but no aisle shall be less than sixteen inches in width and no main to cross aisle be less than two feet six inches in width.

(c) All aisles and passageways in such buildings shall be kept free from camp-stools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any such aisle or passageway during any performance, service, exhibition, lecture, concert or any public assemblage.

502. Emergency Exits for Assembly Rooms—Aggregate Width of.) All assembly halls of such buildings having a seating capacity of eight hundred or more shall be provided with at least two emergency exits. The aggregate width of such emergency exits, which shall be provided for each floor, balcony or gallery of such assembly hall, shall be not less than nine inches in width for every one hundred of seating capacity or portion thereof. No emergency exit or stairway shall be less than three feet in width. Emergency exits must be located as far apart and as far from main exits as practicable, subject to the approval of the Commissioner of Buildings.

503. Exits—Signs.) All exits opening from assembly halls of such buildings shall have the word "EXIT", in letters at least six inches high, applied to the auditorium side of every such exit, and when such assembly hall is in use at night, a red light shall be kept burning over the word "EXIT" during the entire time and until the pupils and audience have left the building.

504. Lights in Buildings—Windows—Skylights.) (a) Every portion of any such building devoted to the uses or accommodation of the public and all outlets therefrom leading to the streets, including the open courts and corridors, stairways, and exits, shall be well and properly lighted during the entire time such portion is in use, and shall remain lighted until all the pupils and the audience have left the premises.

(b) All gas or electric lights in the class rooms of main building and in halls, corridors, lobbies, stairs and exits leading from the assembly halls shall be independent of lights in assembly hall. By "independent" shall be construed a separate pipe from meter or separate circuits from switch-board.

(c) The total glass area of outside windows and skylights of each class room, recitation room or study room in such buildings shall be not less than one-fifth of the floor area of such room.

(d) Class rooms, recitation rooms and study rooms that have exterior windows on one side only must have the top of glass in such windows at a height above the floor of such room of not less than one-half of the distance to the opposite parallel wall or partition.

(e) Such rooms having exterior windows on two opposite sides of the room shall have the top of glass in such windows not less than one-fourth the distance between walls in which the windows are placed. The height of windows in corner rooms having windows in adjacent walls shall be computed from nearest wall or partition to opposite window.

(f) Where skylights or skylights and windows of sufficient size to give the proper

glass area are used these heights of windows shall not be required.

505. Scenery—Sliding Curtains—Screens—Fireproofing Same—Hand Pumps—Fire Extinguishers.) No curtains or scenery shall be used in any assembly hall, except only that it shall be permissible to use a pair of sliding curtains hung on horizontal metal rods not over twelve feet above the floor of stage and portable screens set on the floor and not over eight feet high; *Provided, however, in assembly halls located on the first floor or ground floor of a fireproof building, it shall be permissible to use curtains hung from the ceiling or top of proscenium opening.*

Amended July 28, 1913.

505½. Moving Picture Machines.) *Moving picture machines may be installed and used in assembly halls located on the first floor or ground floor of fireproof buildings of Class VIII. When moving picture machines are so used they shall be located in booths constructed of fireproof materials with metal clad doors and a vent duct to the outside air having a cross sectional area of at least 16 square inches.*

Amended (by adding new Section 505½) July 28, 1913.

506. Easement When Used for Class Rooms.) (a) In every such building in which the lower or basement floor is below the surface of the ground surrounding such building, and is used in part or as a whole for heating or ventilating apparatus, such floor shall be considered the basement story of such building.

(b) Class rooms, recitation rooms or study rooms shall not be allowed in basements less than twelve feet in height in the clear nor where the floor is more than two feet below the level of the sidewalk at nearest entrance of building nor in basements which are not properly lighted by windows or skylights as defined elsewhere in this Chapter for such rooms.

507. Stories—Height of.) No story above the basement shall be less than twelve feet in height in the clear.

508. Fire Escapes.) (a) Every building used for the purposes of Class VIII of four or more stories in height shall be provided and equipped with stairway fire escapes or sliding fire escapes, as herein provided.

Amended February 20, 1911.

(b) All such buildings having a seating capacity of less than two hundred on any one floor above the second floor shall have at least one such fire escape.

(c) All such buildings having a seating capacity of over two hundred but less than four hundred in any one story above the second floor shall have at least two such fire escapes.

(d) All such buildings having a seating capacity of more than four hundred but less than six hundred on any floor above the second floor shall have at least three such fire escapes.

(e) At least one additional stairway or sliding fire escape shall be provided for every increase of two hundred seating capacity in any one story above the second floor.

(f) Stairway fire escapes shall be built in accordance with the requirements of Sections 669, 670 and 672, and shall be subject to the approval of the Commissioner of Buildings.

(g) Sliding fire escapes shall be securely anchored or fastened to the building and shall have a radius or width of not less than thirty-six inches, and the inner side of the same shall be entirely smooth and made of metal. There shall be an entrance to each sliding fire escape from each floor above the first story. They shall be of a pitch of not less than thirty degrees nor more than forty-five degrees for straight runs. They shall be so constructed that

they will discharge people not more than twenty-four inches from the adjacent ground or floor. They shall be of such pattern and design as will best secure the safety of the public, and their construction, location and maintenance shall be subject to the approval of the Commissioner of Buildings. Spiral sliding fire escapes shall have two complete turns for each story height of more than thirteen or less than sixteen feet.

(h) All the provisions of this Chapter relating to outside sliding or stair fire escapes shall apply to buildings of Class VIII, unless such buildings are fireproof, in which case interior fire escapes from ground to roof may be substituted for exterior fire escapes, provided such interior fire escapes shall comply with each and all of the following conditions:

(i) Interior fire escapes in fireproof buildings shall be enclosed in brick or concrete walls on all sides from top to bottom, and shall be enclosed at the top with a fireproof penthouse. The treads and risers of such interior fire escapes shall be the same as those used for stairs elsewhere in the building and the width of such fire escapes shall not be less than forty inches in their narrowest part between hand rails.

(j) The landings of such fire escapes shall, exclusive of and in addition to the space covered or occupied by swinging doors, be at least equal to the stairs in width. All doors leading to such fire escapes shall be incombustible doors and the glass portion thereof shall be glazed with polished wired glass not less than one-quarter of an inch thick, which shall be large enough to enable persons to see other persons on the opposite side of the door. The combined width of said doors on each landing shall exceed the stair width twenty-five per cent, but no single door shall be more than three feet wide. They shall be hinged and equipped with automatic opening and closing devices and shall open outward. Windows lighting such fire escapes shall have metal frames and sash and wired glass.

(k) The number and capacity of such interior fire escapes shall in no case be less than is elsewhere in this Chapter required for outside fire escapes, and the locations of the same shall be as far apart as practicable and so placed as to best secure the safety of the persons using the same in case of fire, accident or panic.

(l) Such interior fire escapes which comply with all the conditions above enumerated may be used daily as ordinary stairs.

509. Inspection—Duties of Engineer—President of Board to Report to Fire Marshal.)

(a) It shall be the duty of the engineer of every building used for the purposes of Class VIII under the control of the Board of Education of this city, where an engineer is employed, or, in case no engineer is employed at such building, it shall then be the duty of the janitor of such building to examine all fire escapes on such buildings from the topmost story to the ground and to examine and operate all floors, windows and platforms leading to and from such fire escapes at least once each and every week that such building is used for school purposes, and to make a written report of such examination to the President of the Board of Education, showing the time it was made and the condition of the fire escapes.

(b) It shall be the duty of the President of the Board of Education to make a written report to the Fire Marshal at least three times a year, showing all such examinations made and the condition in which all fire escapes were found at the time of inspection; also the condition of the doors, win-

dows and platforms leading to and from such fire escapes.

(c) It shall be the duty of the person in charge of each building used for the purposes of Class VIII, other than school buildings under the control of the Board of Education of this city, to make an examination of the fire escapes on school buildings under their charge, from the topmost story to the ground, and to examine and operate all doors, windows, and platforms leading to or from such fire escapes at least once each and every week that such building is used for school purposes, and to make a written report to the Fire Marshal at least three times each year, showing all such inspections made and the condition in which fire escapes, doors, windows and platforms were found at the time of the inspection.

(d) Such fire escapes shall be kept in good condition, ready for immediate use at any and all times that such building is in use and shall be kept free from snow and ice.

(e) The duties herein imposed by this Section shall not be held to relieve the Fire Marshal or Commissioner of Buildings from performing such duties as are otherwise required of them by this Chapter.

510. Fire Drill—Written Report to Fire Marshal.)

(a) The principal or other person in charge of the pupils of every building used for the purposes of Class VIII shall establish and maintain a good and efficient fire drill, which shall be practiced at least twice every month during the time such building is used for school purposes.

(b) A written report shall be made by the principal or other person in charge of the pupils in all school buildings under the control of the Board of Education of this city to the President of said Board of Education of each fire drill held and of the time that elapsed from the first fire signal until the last person was out of the building.

(c) It shall be the duty of the President of the Board of Education to make a written report to the Fire Marshal at least three times each year, which report shall contain a record of all such fire drills practiced in each of the school buildings under the control of the Board of Education of the city.

(d) It shall be the duty of the principal or other person in charge of school buildings, other than those under the control of the Board of Education, to make a written report to the Fire Marshal at least three times each year, showing a record of each fire drill held and the time that elapsed from the first signal until the last person was out of the building.

(e) The duties herein imposed in this Section shall not be held to relieve the Fire Marshal or Commissioner of Buildings from performing such duties as are otherwise required of them by this Chapter.

511. The Commissioner of Buildings, the Fire Marshal, City Electrician and Superintendent of Police Shall Close Buildings for Violations.) The Commissioner of Buildings, Fire Marshal, City Electrician and Superintendent of Police, or any of them, shall have the power to close or order closed any building used wholly or in part for the purposes of Class VIII wherein there is any violation of the provisions of this ordinance, and to keep the same closed until such provisions are complied with.

Note: Article XI-a was added to the Code May 8, 1916.

ARTICLE XI-a.

Class IX.

511a. Class IX Defined.) In Class IX shall be included every building maintained by the City of Chicago for police station purposes.

511b. Requirements General.) Every building of Class IX shall comply with the general provisions of this chapter and in addition to the general provisions shall comply with the following special provisions:

511c. Construction.) (a) All buildings of Class IX not more than two stories and basement in height may be of ordinary mill, slow-burning or fireproof construction.

(b) All buildings of Class IX more than three stories and basement high shall be built of fireproof construction.

All buildings of Class IX containing a court room or court rooms above the second story shall be built of fireproof construction.

All buildings of Class IX three stories and basement or less in height which do not contain a court room or court rooms above the second story may be built of ordinary construction excepting that part of the building containing the cell room or lockup and the patrol wagon quarters, or either of them, which part shall be built of fireproof construction and shall be separated from all other parts of the same building by a wall of the same character and thickness as is required by this chapter for the outside walls of such building and where necessary by a fireproof floor and ceiling of the same thickness as the brick walls by which said floor and ceiling is supported.

(c) Buildings erected for or converted to the use of police stations for temporary purposes may be of mill or slow-burning construction not more than ninety feet in height from the average inside sidewalk grade of the street in front of the building to the highest part of the roof of the building.

511d. Allowance for Live Loads and Construction of Floors of Class IX.) The floors of all buildings of Class IX shall be designed and constructed as follows:

In all buildings of Class IX the floors of all court rooms, and of all public corridors, and of all stairways leading to same, shall be designed and constructed in such a manner as to be capable of bearing in all their parts in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface, and all other floors, or parts thereof, shall be designed as aforesaid capable of carrying a live load of fifty pounds for every square foot of floor surface, and such floor-bearing capacity shall be computed in accordance with the provisions of this chapter.

511e. Windows.) (a) In every building of Class IX every room, including court rooms, public and private offices, shall have at least one window opening directly upon a street, alley, yard or court; the total glass area of such window or windows shall not be less than one-tenth of the floor area of such room. The top of such windows shall be at least seven feet above the floor and at least the upper half of such windows shall be capable of being opened. Such window shall have a glass area of at least ten square feet unless it be a window in excess of one-tenth of the floor area as required by this paragraph. Cell blocks shall have at least three outside walls of same to face upon a street, alley, yard or court and where windows are placed in the three sides with a total glass area equal to one-fourth of the floor area of such block and each window is arranged so that it may be opened for one-half of its area, it shall not be required that each cell open onto a street, alley, yard or court. No sleeping rooms or cell rooms shall be allowed below the first floor level in any building of Class IX.

(b) In every building of Class IX every pantry, bath room, water closet and urinal compartment shall have at least one window which opens directly upon a street, al-

ley, yard, court or vent shaft; the total glass area of such windows shall be not less than one-tenth of the floor area of such room or compartment. The top of such windows shall be at least seven feet above the floor and at least the upper half of such windows shall be capable of being opened; and no such windows shall have a glass area of less than six square feet or a glass width of less than one foot; provided, however, that such room or compartment, if located on the upper story of such building, may be lighted and ventilated by means of a skylight having a glass area of at least one-tenth the floor area of the room it serves and is equipped with an efficient ventilator or ventilators equal in effective area to one-twentieth the floor area of such room.

511f. Courts and Shafts.) In every building of Class IX courts shall be of the minimum width and area as prescribed in Section 442 of this chapter and vent shafts shall be of the minimum width and area as prescribed in Section 443 of this chapter.

511g. Height of Rooms.) In every building of Class IX the height of all rooms except basement rooms shall be not less than ten feet from the level of the floor to the ceiling thereof, and the height of court rooms, if any, shall not be less than eleven feet from the level of the floor to the ceiling thereof.

511h. Thickness of Walls.) The walls of every building of Class IX shall comply in thickness with the requirements of Section 519 of this chapter as therein prescribed for buildings of Class I.

511i. Stairways and Fire Escapes.) Every building of Class IX shall be equipped with stairways and fire escapes in number and dimensions as follows:

In buildings of ordinary, slow-burning or mill construction which do not contain a court room or court rooms and with a floor area of 5,000 square feet or less, two stairways.

With floor area of 5,000 to 9,000 square feet, three stairways.

In buildings of ordinary, slow-burning or mill construction which contain court rooms and with a floor area of less than 5,000 square feet, two stairways and one stairway fire escape.

With floor area of 5,000 to 9,000 square feet, three stairways and one stairway fire escape.

In buildings of fireproof construction with a floor area of 7,000 square feet or less, two stairways.

With floor area of 7,000 to 15,000 square feet, three stairways.

With floor area of 15,000 to 21,000 square feet, four stairways.

All buildings over four stories in height must be equipped with stairway fire escapes as follows:

With a floor area of 7,000 square feet or less, one stairway fire escape, three feet in width.

With a floor area of 7,000 to 21,000 square feet, two stairway fire escapes not less than three feet in width.

No stairways in buildings of Class IX shall be less than four feet in width between hand rails.

In buildings less than three stories high and in buildings three stories high which may be built of ordinary construction by the provisions of this article, stairways may be of ordinary construction enclosed in brick walls of thickness as required by paragraph (b), Sec. 519 of this chapter, or stairways may be of fireproof or incombustible material enclosed in partitions of fireproof or incombustible material.

511j. Exits from Court Rooms.) (a) There shall be two direct exits located as far apart as practicable from every court room in a building of this class; the width of such exits shall be computed on a basis of twenty

inches for each 100 persons of the aggregate capacity of such court room, and for fractional parts of 100 capacity, a proportionate part of twenty inches shall be added to the width of such exits, but no such exits shall be less than three feet wide in the clear. One of such exits shall open onto a public corridor not less than six feet wide from which there is a stairway leading to the ground at least four feet wide in the clear between hand rails. Where there is but one stairway from such public corridor an additional exit from each court room must be afforded by a stairway at least four feet wide in the clear between hand rails or by means of an outside iron stairway not less than three feet wide; the platform of which shall be placed approximately level with the floor of the court room and accessible by a door not less than three feet in width.

511k. Doors to Open Outward.) In buildings of Class IX all doors which afford ingress or egress from all rooms, except private offices, shall open outward.

ARTICLE XII.

General Provisions.

512. Construction or Alteration of Building—Requirements.) Every building or structure or part thereof, hereafter constructed, erected, altered, enlarged, repaired or changed within the City shall be so constructed, erected, altered, enlarged, repaired or changed, in accordance with the provisions of this Chapter.

513. Class of Buildings Not to Be Changed Without Conforming to Provisions of This Chapter.) If buildings, the uses of which bring them within any of the classes mentioned in this Chapter, are to be applied to the uses of any other class for which a better system of construction is required by this Chapter, the construction and equipment of such buildings shall first be made to conform to the requirements of this Chapter as specified for their intended use. And it shall be unlawful to use any such building for a new or different purpose from that to which its structure and equipment adapts it under this Chapter, unless the requirements of this Chapter for such new or different use shall first have been complied with, and a permit for such alteration or use shall have been first obtained from the Commissioner of Buildings.

514. Alterations of Existing Buildings.)

(a) In construing the several sections of this Chapter, said sections shall not be construed as requiring alterations in the construction or equipment of buildings or structures in existence at the time of the passage of this Chapter, except where specifically provided, unless such buildings shall not have sufficient or adequate means of egress therefrom or ingress thereto, by reason of insufficient or inadequate stairways or stairways improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress and except also in sections which are herein made retroactive.

(b) Whenever an Inspector of Buildings shall make a report to the Commissioner of Buildings that any such building has inadequate or insufficient means of egress therefrom or ingress thereto, as aforesaid, the Commissioner of Buildings shall notify the owner, agent, or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building as are necessary to be made in order to make such building comply with the requirements of this Chapter.

(c) If, however, it is desired to enlarge, or in any manner materially modify the construction of any existing building, or to

make a change in its use or occupation which will transfer it from one class as recognized by this Chapter to another class, then, before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, written notice shall be given to the Commissioner of Buildings of the intention to change the character of the use, and the entire building shall be reconstructed or modified in such manner as to bring the same, when enlarged or altered, or when occupied for its new and different purposes, into compliance with the provisions of this Chapter.

***515. Removal of Brick, Stone, Frame or Concrete Buildings.)** It shall be unlawful for any person, firm or corporation to move any brick, stone, frame or concrete building from one location to another, unless the same shall be altered or re-constructed so as to conform to the ordinances governing the construction of such building at the time of moving the same and in its new location; *provided, however, that whenever a tenement house is moved, the same shall be made to comply with the requirements of Section 475 and Section 477 of The Chicago Code of 1911, as amended.*

*Amended July 8, 1912.

516. Live and Dead Loads—Wind Resistance.) (a) The "dead load" shall include all permanent portions of the building, also partitions and permanent fixtures and mechanisms supported by the building.

(b) All buildings shall be designed to resist a horizontal wind pressure of 20 lbs. per square foot for every square foot of exposed surface. In no case shall the overturning moment due to wind pressure exceed seventy-five per cent of the moment of stability of the building due to the dead load only.

(c) The "live" loads per square foot of floor areas, except stairs, for the classes of buildings except portions of Class VIII as hereinafter provided shall be not less than the following:

	Pounds.
Class I.....	100
Class II.....	50
Class III.....	40
Class IV.....	100
Class V.....	100
Class VI.....	40
Class VII.....	100
Class VIII.....	75

(d) Provided, however, that in Class VIII the portions of the building exclusive of the floors in assembly halls, the corridors and the stairs, shall not be required to be constructed to support a live load in excess of 40 pounds per square foot.

(e) The roofs of all buildings shall be designed and constructed in such a manner that they will bear a load in addition to the weight of their structure and covering, of at least twenty-five pounds for each square foot of horizontal surface.

(f) The live loads on stairways for buildings of all classes shall not be less than 100 pounds per square foot of treads and landings.

***517. Structural Details—Strength Tests—How Made.)** (a) All structural details and workmanship shall be in accordance with accepted engineering practice, and subject to the approval of the Commissioner of Buildings.

(b) Floors, joists and beams shall be designed for the full dead and live loads. Floor girders shall be designed for the full dead and not less than eighty-five per cent of the live load.

(c) *In buildings of Classes III and IV, except frame buildings, where the distance between enclosing walls or intermediate walls is more than twenty-five feet in the clear, intermediate*

walls are not more than fourteen feet in height and are supported by a foundation or wall not less than twelve inches in thickness.

(h) A brick wall not more than twenty-five feet long and forming one side of a brick shaft for stair, elevator or other purposes, need not exceed sixteen inches in thickness, nor its upper fifty feet twelve inches in thickness, provided that in no case shall the load on such brick wall exceed the safe load for brickwork prescribed by this ordinance.

(i) The length of a wall shall be the distance in which the walls extends in a straight line and shall be measured between angles of the masonry or between exterior and cross walls.

(j) Where masonry buttresses or piers or pilasters are employed on either or both sides of a wall, then said walls may be reduced in thickness by one-half of the projection or projections of the buttresses or piers or pilasters. The reduction in thickness may be made throughout the height of the wall, except that no 12-inch wall shall be higher than thirty feet and no 16-inch wall shall be higher than fifty feet. The stress in the brick work in any part of such walls shall not exceed the stress per square inch allowed by this Chapter on the kind of masonry employed. Buttresses or piers or pilasters shall be at least one-tenth as wide as the spacing between the buttresses or piers or pilasters. Twelve-inch walls or less between buttresses or piers or pilasters shall not be used where the distance between buttresses or piers or pilasters is greater than eighteen feet. Sixteen-inch walls or less shall not be used between buttresses or piers or pilasters where the distance is greater than twenty-four feet between buttresses or pilasters. Twenty-inch walls or less shall not be used between buttresses or piers or pilasters where the distance is greater than thirty feet between buttresses or piers or pilasters.

(k) Where buttresses are used, they shall be so placed that the principal girders and trusses shall bear on them.

(l) If the loads carried by trusses and girders are supported by iron, steel, or reinforced concrete columns, then such buttresses as are herein described shall not be required except for the fireproofing of steel and iron columns. The walls between such columns shall be built as required by this Chapter, and said walls shall be anchored to such columns by metal anchors in every seven feet to the height of such column.

(m) A structural floor system shall extend from one wall to an opposite wall, and the walls shall be anchored to floor joists or girders or both with iron anchors placed opposite one another, secured to the same joists or girders in pairs, every seven feet or less of length of said walls. Where said joists or girders are of such length that it is not practicable to make them of one piece, then the several pieces shall be joined at each splice or joint by the tie plates or tie bars or other metal connections of the same strength as the anchors. Such anchors shall have not less than four-tenths of a square inch of metal in its smallest cross-sectional area. The spikes, bolts or screws, securing said anchors and tie plates, shall be of such number and size as to transmit the tensile strain which the anchor is capable of resisting into the joists or girders to which said anchors are connected. All pin anchors shall extend at least eight inches into the supporting masonry.

(n) The story height of buildings shall be the distance between structural floor systems or between such structural floor systems and structural roof systems and shall be as follows:

Where 12-inch walls are used, the story height shall not exceed 18 feet.

Where 16-inch walls are used, the story height shall not exceed 24 feet.

Where 20-inch walls are used, the story height shall not exceed 30 feet.

(o) Where the story height is greater than thirty feet, the walls shall not be of less thickness than the following: The upper fifteen feet shall be not less than sixteen inches in thickness, and the walls shall be increased four inches in thickness at each interval of fifteen feet or fractional part thereof of height.

(p) Curtain walls in skeleton construction buildings may be of hollow clay tile of the same thickness as herein required for brick walls.

(q) The walls of buildings to be used for the purposes of Classes III and VI and not more than two stories in height may be of hollow clay tile or moulded hollow concrete blocks not thinner than the thickness herein required for brick walls, subject to the approval of the Commissioner of Buildings.

(r) *Interior brick walls used to support fireproof floor construction, where brick walls are not required by this chapter, may be built thinner than the thickness required by the provisions of paragraph (a) of this section, provided the proportion between the thickness of such walls and the free height between floors does not exceed fifteen, and further provided the unit stresses do not exceed the stresses allowed by this chapter, and provided, also, that no such wall shall be constructed of a thickness less than twelve inches.*

Paragraph (r) amended July 15, 1912.

520. Ledges—Joist Supports.) (a) In buildings two stories or more in height wherever party walls or partition walls twelve inches or less in thickness are used for the support of wood joists in buildings of Classes I, II, IV, V, VII and VIII the joists shall be supported on ledges of brick formed by corbeling not less than four courses of brick and the upper course shall project four inches beyond the face of the wall, and the joists shall be protected from the bottom to the top of same for the distance of the projection of the corbel by solid brick work laid in mortar.

(b) Wherever iron or steel joist and girder boxes having five complete sides of iron, nowhere less than $\frac{1}{4}$ -inch in thickness, are used, corbels and ledges as herein specified may be omitted.

(c) In buildings of every class where wood furring is used on brick walls, the brick between joists shall be projected from the bottom of the joist to the top of the joist for the full thickness of the furring and in no case shall such projection be less than two inches.

521. Walls of Altered Buildings—Increasing Thickness of.) If the walls of a building are not of sufficient thickness to comply with the requirements of this Chapter for an enlarged or modified building, then the thickness of the existing walls shall be increased by building alongside of them a new wall, which shall not, however, be less in any part thereof than twelve inches thick, and which shall be increased in thickness by four inches for at least every forty feet in the height of such wall. Such new wall shall be laid in Portland cement mortar and shall be anchored to the old wall, but bonding with brick or masonry will not be considered as complying with this Chapter; and if an increase in the height of the building is contemplated, the wall from the top of the old wall shall be built jointly upon the new and old walls. If solid masonry buttresses are introduced in connection with such thickening and strengthening of existing walls, the intervening wall may be re-

duced to eight inches in thickness, provided such buttresses are sufficient in number and in area to make the resultant structure of equal strength with the solid wall already specified. Provided, however, that steel or iron columns or beams may be used instead of such new wall, such columns or beams to be bolted or bonded to the existing wall in a manner satisfactory to and approved by the Commissioner of Buildings.

522. Walls—Party.) The provisions of the preceding section shall also apply to all cases where existing party walls are to be joined to for the erection of new buildings. But in the case of party walls, which at the time of their erection were built in accordance with the terms of the city ordinances then in force, such walls, if sound and in good condition, may be used without increase of thickness for any building not higher than and of the same class as the building for which the original wall was built.

523. Walls—Erection of—Walls and Skeleton Framework Securely Braced.) In the erection of buildings of masonry construction, no wall shall be carried up at any time more than two stories above another wall of the same building. The walls and skeleton framework of all buildings shall be kept securely braced and otherwise protected against the effects of the weather during all building operations.

524. Parapet Walls—When Required on Walls and Porches—Thickness and Height of.) (a) On all flat roof buildings parapet walls shall be erected, except as hereinafter provided, on all exterior walls and on all partition walls required by this ordinance by reason of the area of such buildings; provided, that such parapet walls may be dispensed with on any wall of a fireproof building, and on street and alley walls and on yard and court walls of buildings of other types where the entire framing and materials of the roof are strictly fireproof or where all portions of the roof nearer than fifteen feet to the lot line of such street or alley or bounding such yard or court are protected against fire by a continuous covering of porus or hollow tiles, not less than two inches thick and surfaced with mortar, on top of the roof boards.

(b) Such parapet walls may be eight inches thick wherever this ordinance permits the use of eight-inch walls; elsewhere they shall be not less than twelve inches in thickness.

(c) Such parapet walls shall extend at any point not less than three feet vertically above the roof on all such required partition walls and on all other walls within less than three feet of any division lot line and approximately parallel therewith; elsewhere they shall extend not less than eighteen inches above the roof.

(d) On all buildings whose roofs have a greater pitch than three inches per horizontal foot, parapet walls, of thickness and height as above specified, shall be erected on required partition walls, on exterior walls approximately parallel with and less than three feet distant from a division lot line, and on walls abutting on another building. Provided, that such parapet walls may be dispensed with where the entire framing and materials of the roof are fireproof or where the cornice and roof covering are of incombustible material and the top of the roof boards is protected against fire for at least five feet up from such wall by a coating of plaster on porus or hollow tiles at least two inches thick; and further provided that such parapet walls and such protection against fire may be dispensed with on buildings of Classes III and VI, three stories or less in height when such buildings have cornices of incombustible ma-

terial and roof coverings of slate or terra cotta roofing tile.

525. Allowable Stresses and Special Requirements for Foundations—Bearing on Various Soils.) (a) If the soil is a layer of pure clay at least fifteen feet thick, without admixture of any foreign substance other than gravel, it shall not be loaded to exceed 3,500 pounds per square foot. If the soil is a layer of pure clay at least fifteen feet thick and is dry and thoroughly compressed, it may be loaded not to exceed 4,500 pounds per square foot.

(b) If the soil is a layer of firm sand fifteen feet or more in thickness, and without admixture of clay, loam or other foreign substance, it shall not be loaded to exceed 5,000 pounds per square foot.

(c) If the soil is a mixture of clay and sand, it shall not be loaded to exceed 3,000 pounds per square foot.

526. Foundations in Wet Soil—Trenches to Be Drained.) In all cases where foundations are built in wet soil, it shall be unlawful to build the same unless trenches in which the work is being executed are kept free from water by bailing, pumping, or otherwise, until after the completion of work upon the foundations and until all cement has properly set. In all cases a connection with the street sewer shall be established before beginning the work of laying foundations.

***527. Foundations—Where not Permitted—Depth Below Surface—Independent of Underground Construction Owned or Controlled by the City.)** (a) Foundations shall not be laid on filled or made ground or on loam, or on any soil containing admixture of organic matter, and must rest on hard, sound soil. Foundations shall in all cases extend at least four feet below the finished surface of the ground upon which they are built, unless footings rest on bed rock.

(b) Foundations shall in all cases extend at least four feet below the surface of the ground upon which they are built, and in the case of all buildings 100 feet or more in height, foundations shall extend at least to the depth drained by the street sewer in the adjacent streets or alleys; but if such sewers are at a greater depth than ten feet below the sidewalk grade, such foundations need not extend to a greater depth than ten feet, provided that sound, hard soil is found at that depth.

(c) Every building forty feet or more in height, hereafter erected, which is located adjacent to any street or alley containing any then existing water main, water tunnel, sewer, conduit, tunnel, subway or other underground construction, owned or controlled by the City, shall be so constructed that the foundation or superstructure thereof shall not be supported in whole or in part by any such underground construction.

*Amended December 19, 1910.

528. Foundation Construction.) Foundations shall be constructed of stone, gravel or slag concrete, dimension stone or rubble stone, sewer or paving bricks, iron or steel imbedded in concrete or piles, or a combination of any of the same. All masonry foundations shall be laid in cement mortar.

529. Foundation of New and Old Walls.) In all cases where there is an increase in the thickness of walls, a new foundation shall be built in such a manner as to carry jointly both the new and old walls, and the soil under such foundations shall not be loaded beyond the limits specified in this Chapter.

All foundations shall be protected against the effects of frost, and cement mortar which has been affected by frost, shall not be used in building operations.

530. Foundations—Pile Borings Required—Safe Load Required—Fiber Stress.) (a) Where pile foundations are used, the Commissioner of Buildings may require auger borings of the soil to be made to determine the position of the underlying stratum of hard clay or rock. The heads of the piles shall be protected against splitting while they are being driven. The piles shall be sawed off to a uniform level at least one foot below Chicago datum after being driven, and the heads shall be imbedded in concrete or covered with a grillage so proportioned that in the transmission of the load from the structure to the pile the stresses in the materials shall not exceed that prescribed in this Chapter. The top of timber grillage shall be at least one foot below Chicago datum.

(b) The center of gravity of a pile foundation shall coincide with the center of gravity line of the load or loads which it carries.

(c) No pile of less than six inches diameter at small end shall be used.

(d) The safe load on a pile shall be determined by and shall not exceed the following formula:

$$P = \frac{2wh}{S+1} \text{ for steam hammer;}$$

$$S = \frac{1}{10} \frac{2wh}{S+1}$$

$$P = \frac{S+1}{S} \text{ for drop hammer;}$$

In which formula

S=set in inches.

h=fall in feet.

w=weight of hammer.

P=safe load in pounds.

(e) The maximum load on a timber pile shall not exceed 50,000 pounds.

(f) A wood follower shall not be used in determining the safe load.

(g) Plans for pile foundations shall be submitted to the Commissioner of Buildings for approval and shall specify the least diameter of small end of piles, and no piles with smaller diameter of points than that specified for the job shall be used.

(h) There shall not be less than two rows of piles under all external party walls or other walls less than seventy feet high, and not less than three rows under all walls over seventy feet high, excepting under walls not exceeding fifty feet in height a single staggered row of piles may be used if other conditions of stability are complied with.

531. Concrete Piles Allowable—Compression—Tests—How Made. (a) Where concrete piles are used test piles shall be driven and loaded under the general direction of the Commissioner of Buildings.

(b) The allowable compression of concrete piles shall not exceed 400 pounds per square inch at a section six feet from the surface of the ground in immediate contact with the pile.

(c) These tests shall conform to the following regulations: Tests shall be made on at least two piles in different locations and as directed by the Commissioner of Buildings. Not less than three piles to be driven for each test. The pile to be loaded to be driven first, the second pile to be driven within six hours of the driving of the first, the third pile to be driven within twenty to twenty-four hours after the first. The two latter shall each be driven with centers not to exceed twice the greatest diameter of pile, from the center of the test pile.

(d) The tests shall not be started until at least ten days after the piles to be loaded are driven, except that piles that have been cast and set up before driving may be tested as soon as practicable after driving. The piles shall be loaded with twice the proposed carrying load of the piles.

(e) The settlement shall be measured daily until twenty-four hours shows no settlement.

(f) One-half of the test load shall be allowed for the carrying load, if the test shows no settlement for twenty-four hours and the total settlement has not exceeded one one-hundredths of an inch multiplied by the test load in tons.

532. Steel Rails or Beams in Concrete.) If steel or iron rails or beams are used as parts of foundations, they shall be entirely imbedded in concrete extending not less than four inches beyond the metal.

See Special Ruling V, Page 170.

533. Allowable Stresses and Special Requirements for Masonry.) (a) Allowable stresses in pounds per square inch on plain concrete and stone masonry shall not exceed the following:

	Lbs.
Coursed rubble Portland cement mortar	200
Ordinary rubble Portland cement mortar	100
Coursed rubble lime mortar.....	120
Ordinary rubble lime mortar.....	60
First-class granite masonry, Portland cement mortar.....	600
First-class lime and sandstone masonry, Portland cement mortar.....	400
Portland cement concrete 1-2-4 mixture, machine mixed.....	400
Portland cement concrete 1-2-4 mixture, hand mixed.....	350
Portland cement concrete 1-2½-5 mixture, machine mixed.....	350
Portland cement concrete 1-2½-5 mixture, hand mixed.....	300
Portland cement concrete 1-3-6 mixture, machine mixed.....	300
Portland cement concrete 1-3-6 mixture, hand mixed.....	250
Natural cement concrete 1-2-5 mixture	150

(b) Allowable compression in pounds per square inch on brick masonry shall not exceed the following:

	Lbs.
No. 1 paving brick, 1 part Portland cement, 3 parts torpedo sand.....	350
No. 2 pressed brick and sewer brick, mortar same as referred to above...	250
No. 3 hard common select brick, Portland cement mortar, same as referred to above.....	200
No. 4 hard common select brick, 1 part Portland, 1 lime, 3 sand as referred to above.....	175
No. 5 common brick, all grades, Portland cement mortar.....	175
No. 6 common brick, all grades, good lime and cement mortar.....	125
No. 7 common brick, all grades, natural cement mortar.....	150
No. 8 common brick, all grades, good lime mortar.....	100

(c) Brick under Nos. 1 and 2 shall not crush at less than 5,000 pounds pressure per square inch of gross area.

(d) Brick under Nos. 3 and 4 shall not crush at less than 2,300 pounds pressure per square inch of gross area.

(e) Brick under Nos. 5, 6, 7 and 8 shall not crush at less than 1,800 pounds pressure per square inch of gross area. Sand lime brick, of this crushing strength may be used where common brick is permitted.

(f) Isolated piers of concrete, brick, or masonry shall not be higher than six times their smallest dimensions unless the above unit of stresses are reduced according to the following formula:

$$P \text{ equals } C \left(1.25 \text{ minus } \frac{H}{20D} \right)$$

In which formula

P is the reduced allowed unit stress.

C is the unit stress in the above table.

H is the height of the pier in feet.

D is the least dimension of the pier in feet.

(g) No pier shall exceed in height twelve times the least dimension. Weight of pier shall be added to other loads in computing load coming on the pier.

534. Definitions of Masonry.) All masonry construction shall be defined as and comply with the following:

(a) Ordinary Rubble shall be defined as masonry composed of unsquared stones laid without attempting any regularity of courses or bond;

(b) Coursed Rubble shall be defined as masonry having approximately level joints; stones to be roughly shaped so as to fit approximately; joints in wall or pier to be leveled off every three (3) feet in height and to be well bonded.

(c) First Class Masonry shall be defined as masonry built of stones in regular courses, the bearing surfaces of which as well as ends, to be roughly tooled off and shall be laid with alternate headers and stretchers so as to secure perfect bond.

535. Ashlar Facing.) (a) Ashlar facing of masonry walls shall only be considered as part of wall for the purpose of carrying weight, when it has a minimum bond as follows:

(b) Every second course to be a bond course, this bond course to extend into the backing a distance equal to the least thickness of ashlar. In addition to such bond,

each stone in all courses shall be tied to backing by two galvanized iron anchors. No ashlar shall be less than four inches thick, nor shall the height of any stones exceed five times its thickness.

536. Soft Bricks—Where Not Permitted.) Soft bricks shall not be used in any part of a building where exposed to the weather, nor in external or internal piers of bearing walls.

537. Brickwork—Bond of.) The bond of all brickwork shall be formed by laying one course of headers for every five courses of stretchers; provided that in the case of pressed brick facing, two headers and a stretcher may be laid alternately in every sixth course or an equivalent number of full headers may be used in any other arrangement approved by the Commissioner of Buildings; and provided further, that pressed brick facing, when not counted as part of the bearing wall, may be laid with fewer or no header courses if anchored to the backing by metal ties of design, material, weight and quantity approved by the Commissioner of Buildings.

538. Bricks—How Laid.) All brick laid up in cement, or lime and cement mortar, shall be thoroughly drenched immediately before being laid unless laid in freezing weather. Both horizontal and vertical joints shall be filled with mortar in all kinds of brick masonry.

***539. Allowable Stresses and Special Requirements for Timber.)** The maximum allowable stresses in pounds per square inch on actual sections for timber shall be as follows

	Extreme Fibre Stress and Tension with Grain.	Compression with Grain.	Compression Across Grain in Build- ings Hereafter Erected.	Compression Across Grain in Existing Buildings.	Shear with Grain.
Douglas Fir and Long Leaf Yellow Pine....	1,300	1,100	250	400	130
Oak	1,200	900	500	600	200
Short Leaf Yellow Pine.....	1,000	800	250	300	120
Norway Pine	800	700	200	300	80
White Pine	800	700	200	300	80
Hemlock	600	500	150	300	60

The unit stress on timber posts shall comply with the formula:

$$C = \left(1 - \frac{L}{80D}\right)$$

In which formula:

C equals compressive strength of timber with the grain as given in the table

L equals length in inches.

D equals least diameter inches.

The maximum length of a timber post shall not exceed thirty diameters.

Timber columns shall not be used in buildings of greater height than twice the width of the building nor in buildings over one hundred feet in height.

*Amended February 14, 1913.

540. Quality of Timber.) Timber used for building purposes shall be sound, well manufactured, close grained, free from wind shakes, or from dead, loose, decayed, encased or pitch knots, or knots and other defects that will materially impair its strength and durability.

541. Maximum Allowable Stresses and Special Requirements for Metals.) (a) The maximum allowable stresses in pounds per square inch in steel and iron shall not exceed the following:

	Rolled Steel.	Cast Steel.	Wrought Iron.	Cast Iron.
Tension on net section.....	16,000	16,000	12,000	.....
Maximum compression on gross section.....	14,000	14,000	10,000	10,000
Bending on extreme fibre.....	16,000	16,000	12,000	.....
Bending on extreme fibre tension.....	.....	.....	.....	3,000
Bending on extreme fibre compression.....	.....	.....	.....	10,000
Bending on extreme fibres of pins.....	25,000	.....	.....	.....
Shear: shop driven rivets and pins.....	12,000	.....	.....	.....
Shear: field driven rivets.....	10,000	.....	.....	.....
Shear on rolled steel shapes.....	12,000	.....	.....	.....
Shear plate girder webs; gross section.....	10,000	.....	.....	.....
Shear on brackets .....	.....	.....	.....	2,000
Bearing, shop driven rivets and pins.....	25,000	.....	.....	.....
Bearing, field rivets	20,000	.....	.....	.....

(b) The allowable compressive stresses per square inch shall be determined by the following formula:

$$\begin{aligned} & \text{Steel} \dots\dots\dots 16,000 - 70 \frac{L}{R} \\ & \text{Wrought iron} \dots\dots\dots 12,000 - 60 \frac{L}{R} \\ & \text{Cast iron} \dots\dots\dots 10,000 - 60 \frac{L}{R} \end{aligned}$$

In the above formulæ:

L equals length in inches.

R equals least radius of gyration in inches.

(c) In no case shall the allowable compressive stress exceed that given in paragraph (a) of this section.

(d) For steel columns filled with, and encased in concrete extending at least three inches beyond the outer edge of the steel, where the steel is calculated to carry the entire live and dead load, the allowable stress per square inch shall be determined by the following formulæ:

$$18,000 - 70 \frac{L}{R}$$

but shall not exceed 16,000 pounds.

(e) For steel columns filled with, but not encased in, concrete the steel shall be calculated to carry the entire live and dead load. In this case the above formulæ may be used, but the allowable stress shall not exceed 14,000 pounds.

(f) Stress due to eccentric loading shall be provided for in all compressive members.

(g) The length of rolled steel compressive members shall not exceed one hundred twenty times the least radius of gyration, but the limiting length of struts for wind bracing only may be one hundred fifty times the least radius of gyration. The limiting length for cast iron columns shall be seventy times the least radius of gyration.

(h) Cast iron columns shall not be used in buildings of greater height than twice the least width, or in buildings over 100 feet high.

542. Live and Dead Loads—Stress.) (a) Wherever the live and dead load stresses are of opposite character, only 70 per cent of the dead load stress shall be considered as effective in counteracting the live load stress.

(b) For stresses produced by wind forces combined with those from live and dead load, the unit stress may be increased fifty per cent. over those given above; but the section shall not be less than required if wind forces be neglected.

543. Riveting—Tension.) (a) In proportioning tension members the diameter of the rivet holes shall be taken one-eighth of an inch larger than the nominal diameter of the rivet.

(b) In proportioning rivets the nominal diameter of the rivet shall be used.

(c) Pin-connected riveted tension members shall have a net section through the pin-hole at least 25 per cent in excess of the net section of the body of the member and the net section back of the pin-hole, parallel with the axis of the member, shall not be less than the net section of the body of the member.

544. Plate Girders — Flanges — Compression.) (a) Plate girders shall be proportioned either by the moment of inertia of their net section, or by assuming that the flanges are concentrated at their centers of gravity and a unit stress used such that the extreme fibre stress does not exceed 16,000 pounds per square inch, in which case one-eighth of the gross section of the web, if properly spliced, may be used as flange section.

(b) The gross section of the compression flanges of plate girders shall not be less than the gross section of the tension flanges; nor shall the stress per square inch in the compression flange of any beam or girder of a longer length than 25 times the width exceed.

$$20,000 - 160 \frac{L}{B}$$

In which formula

L equals unsupported distance and

B equals width of flange.

(c) The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer the total shear at any point in a distance equal to the effective depth of the girder at that point combined with any load that is applied directly on the flanges.

(d) Webs of plate girders shall be provided with stiffeners over all bearing points, under all points of concentrated loading and elsewhere when required by good engineering practice.

Reinforced Concrete.

545. Reinforced Concrete — Definition —

Plans.) The term "Reinforced Concrete" means any combination of metal imbedded in concrete to form a structure so that the two materials assist each other to sustain all the stresses imposed. Before a permit to erect any reinforced concrete structure is issued, complete plans and specifications shall be filed with the Commissioner of Buildings, showing all details of the construction, including detail of working joints, the size and position of all reinforced rods, stirrups or other forms of metal, and giving the composition and proportion of the concrete; provided, however, that permission to erect any reinforced concrete structure does not in any manner approve the construction until after tests have been made of the actual construction to the satisfaction of the Commissioner of Buildings.

546. Ratio of Moduli of Elasticity—Adhesion—Bond.) (a) The calculations for the strength of reinforced concrete shall be based on the assumed ultimate compressive strength per square inch designated by the letter "U" given in the table below for the mixture to be used.

(b) The ratio designated by the letter "R" of the modulus of elasticity of steel to that of the different grades of concrete shall be taken in accordance with the following table:

Mixture.	U	R
1 cement, 1 sand, 2 broken stone, gravel or slag	2,900	10
1 cement, 1½ sand, 3 broken stone, gravel or slag	2,400	12
1 cement, 2 sand, 4 broken stone, gravel or slag	2,000	15
1 cement, 2½ sand, 5 broken stone, gravel or slag	1,750	18
1 cement, 3 sand, 7 broken stone, gravel or slag	1,500	20

See Special Ruling II, Page 168.

547. Unit Stresses for Steel and Concrete.) (a) The stresses in the concrete and the steel shall not exceed the following limits:

(b) Tensile stress in steel shall not exceed one-third of its elastic limits and shall not exceed 18,000 pounds per square inch.

(c) Shearing stress in steel shall not exceed 12,000 pounds per square inch.

(d) The compressive stress in steel shall not exceed the product of the compressive stress in the concrete multiplied by the elastic modulus of the steel and divided by the elastic modulus of the concrete.

(e) Direct compression in concrete shall be one-fifth of its ultimate strength. Bending in extreme fibre of concrete shall be thirty-five one-hundredths of the ultimate strength.

(f) Tension in concrete on diagonal plane shall be one-fiftieth of the ultimate compressive strength.

(g) For a concrete composed of one part of cement, two parts of sand and four parts of broken stone, the allowable unit stress for adhesion per square inch of surface of imbedment shall not exceed the following:

	Pounds Per Sq. Inch.
On plain round or square bars of structural steel	70
On plain round or square bars of high carbon steel	50
On plain flat bars, in which the ratio of the sides is not more than 2 to 1....	50
On twisted bars when the twisting is not less than one complete twist in eight diameters	100

(h) For specially formed bars, the allowable unit stress for bond shall not exceed one-fourth of the ultimate bond strength of such bars without appreciable slip which shall be determined by tests made by the person, firm or corporation to the satisfaction of the Commissioner of Buildings, but provided that in no case shall such allowable unit stress exceed 100 pounds per square inch of the specially formed bars.

548. Design for Slabs, Beams and Girders.) Reinforced concrete slabs, beams and girders shall be designed in accordance with the following assumptions and requirements:

(a) The common theory of flexure shall be applied to beams and members resisting bending.

(b) The adhesion between the concrete and the steel shall be sufficient to make the two materials act together.

(c) The steel to take all the direct tensile stresses.

(d) The stress strain curve of concrete in compression is a straight line.

(e) The ratio of the moduli of elasticity of concrete to steel shall be as specified in the table in Section 546.

See Special Ruling III, Page 168.

549. Moments of External Forces.) (a) Beams, girders, floor or roof slabs and joists shall be calculated as supported, or with fixed ends, or with partly fixed ends, in accordance with the actual end conditions, the number of spans and the design.

(b) When calculated for ends partly fixed for intermediate spans with an equally distributed load where the adjacent spans are of approximately equal lengths:

Bending moment at center of spans shall not be less than that expressed in the formula $\frac{WL^2}{12}$ for intermediate spans and $\frac{WL^2}{10}$ for end spans.

(c) The moment over supports shall not be less than the formula $\frac{WL^2}{18}$ and the sum of the moments over one support and at the center of span shall be taken not less than the formula $\frac{WL^2}{6}$.

In the formula hereinabove given "W" is the load per lineal foot and "L" the length of span in feet.

(d) In case of concentrated or special loads the calculations shall be based on the critical condition of loading.

(e) For fully supported slabs, the free opening plus the depth, for continuous slabs, the distance between centers of supports, is to be taken as the span.

(f) Where the vertical shear, measured on the section of a beam or girder between the centers of action of the horizontal stresses, exceeds one-fifth of the ultimate direct compressive stress per square inch, web reinforcement shall be supplied sufficient to carry the excess. The web reinforcement shall extend from top to bottom

of beam, and loop or connect to the horizontal reinforcement. The horizontal reinforcement carrying the direct stresses shall not be considered as web reinforcement.

(g) In no case, however, shall the vertical shear, measured as stated above, exceed one-fifteenth of the ultimate compression strength of the concrete.

(h) For T beams the width of the stem only shall be used in calculating the above shear.

(i) When steel is used in the compression side of beams and girders, the rods shall be tied in accordance with requirements of vertical reinforced columns with stirrups connecting with the tension rods of the beams or girders.

(j) All reinforcing steel shall be accurately located in the forms and secured against displacement; and inspected by the representative of the architect or engineer in charge before any surrounding concrete be put in place. It shall be afterwards completely inclosed by the concrete, and such steel shall nowhere be nearer the surface of the concrete than $1\frac{1}{2}$ -inch for columns, $1\frac{1}{4}$ inch for beams and girders, and $\frac{1}{2}$ -inch, but not less than the diameter of the bar, for slabs.

(k) The longitudinal steel in beams and girders shall be so disposed that there shall be a thickness of concrete between the separate pieces of steel of not less than one and one-half times the maximum sectional dimension of the steel.

(l) For square slabs with two-way reinforcements the bending moment at the center of the slab shall not be less than that

expressed in the formula $\frac{WL^2}{24}$ for intermediate spans, and $\frac{WL^2}{20}$ for end spans.

(m) The moment over supports shall not be less than the formula $\frac{WL^2}{36}$ and the sum of the moments over one support and at the center of the span shall be taken not less than the formula $\frac{WL^2}{12}$.

In which above formula "W" is the load per lineal foot and "L" the length of the span.

(n) For squares or rectangular slabs, the distribution of the loads in the two directions, shall be inversely as the cubes of the two dimensions.

(o) Exposed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and the plaster finish applied over the metal shall not be deemed sufficient protection unless applied of sufficient thickness and so secured as to meet the approval of the Commissioner of Buildings.

See Special Ruling II, Page 168.

550. Limiting Width of Flange in "T" Beams.) (a) In the calculation of ribs, a portion of the floor slab may be assumed as acting in flexure in combination with the rib. The width of the slab so acting in flexure is to be governed by the shearing resistance between rib and slab, but limited to a width equal to one-third of the span length of the ribs between supports and also limited to a width of three-quarters of the distance from center to center between ribs.

(b) No part of the slab shall be considered as a portion of the rib, unless the slab and rib are cast at the same time.

(c) Where reinforced concrete girders support reinforced concrete beams, the portion of floor slab acting as flange to the girder must be reinforced with rods near the top, at right angles to the girder, to ena-

ble it to transmit local loads directly to the girder and not through the beams.

551. Shrinkage and Thermal Stresses.) Shrinkage and thermal stresses shall be provided for by introduction of steel.

552. Reinforced Concrete Columns—Limit of Length—Per Cent of Reinforcement—Bending Moment in Columns—Tying Vertical Rods.) (a) Reinforced concrete may be used for columns in which the concrete shall not be leaner than a 1:2:4 mixture and in which the ratio of length to least side or diameter does not exceed twelve, but in no case shall the cross section of the column be less than 64 square inches. Longitudinal reinforcing rods must be tied together to effectively resist outward flexure at intervals of not more than twelve times least diameter of rod and not more than 18 inches. When compression rods are not required, reinforcing rods shall be used, equivalent to not less than one-half of one per cent (.005) of the cross sectional area of the column; provided, however, that the total sectional area of the reinforcing steel shall not be less than one square inch, and that no rod or bar be of smaller diameter or least dimensions than one-half inch. The area of reinforcing compression rods shall be limited to three per cent. of cross sectional area of the column. Vertical reinforcing rods shall extend upward or downward into the column, above or below, lapping the reinforcement above or below enough to develop the stress in rod by the allowable unit for adhesion. When beams or girders are made monolithic with or rigidly attached to reinforced concrete columns, the latter shall be designed to resist a bending moment equal to the greatest possible unbalanced moment in the beams or girders at the columns, in addition to the direct loads for which the columns are designed.

(b) When the reinforcement consists of vertical bars and spiral hooping, the concrete may be stressed to one-fourth of its ultimate strength as given in Section 546, provided, that the amount of vertical reinforcement be not less than the amount of the spiral reinforcement, nor greater than eight per cent. of the area within the hooping; that the percentage of spiral hooping be not less than one-half of one per cent. nor greater than one and one-half per cent.; that the pitch of the spiral hooping be uniform and not greater than one-tenth of the diameter of the column, nor greater than three inches; that the spiral be secured to the verticals at every intersection in such a manner as to insure the maintaining of its form and position, that the verticals be spaced so that their distance apart, measured on the circumference be not greater than nine inches, nor one-eighth the circumference of the column within the hooping. In such columns, the action of the hooping may be assumed to increase the resistance of the concrete equivalent to two and one-half times the amount of the spiral hooping figured as vertical reinforcement. No part of the concrete outside of the hooping shall be considered as a part of the effective column section.

553. Structural Steel Columns.) When the vertical reinforcement consists of a structural steel column of box shape, with lattice or battenplates of such a form as to permit its being filled with concrete, the concrete may be stressed to one-fourth of its ultimate strength as given in table in Section 546, provided that no shape of less than one square inch section be used and that the spacing of the lacing or battens be not greater than the least width of the columns.

554. Curtain Walls in Skeleton Construction Buildings.) Buildings having a complete skeleton construction of steel or of

reinforced concrete construction, or a combination of both, may have exterior walls of reinforced concrete eight inches thick; provided, however, that such walls shall support only their own weight and that such walls shall have steel reinforcement of not less than three-tenths of one per cent in each direction, vertically and horizontally, the rods spaced not more than twelve-inch centers and wired to each other at each intersection. All bars shall be lapped for a length sufficient to develop their full stress for the allowable unit stress for adhesion. Additional bars shall be set around openings, the verticals wired to the nearest horizontal bars, and the horizontal bars at top and bottom of openings shall be wired to the nearest vertical bars. The steel rods shall be combined with the concrete and placed where the combination will develop the greatest strength, and the rods shall be staggered or placed and secured so as to resist a pressure of thirty pounds per square foot, either from the exterior or from the interior on each and every square foot of each wall panel.

555. Bending and Elongation of Steel.) The bending and elongation of steel used in reinforced concrete construction shall conform to the following requirements: (a) Steel having a diameter of three-fourths of an inch or less shall be capable of bending cold ninety degrees over a diameter equal to twice the thickness of the piece without fracture; steel over three-fourths inch in diameter shall be capable of bending cold to ninety degrees over a diameter equal to three times the diameter of the piece.

(b) The material of reinforcement shall be such form that it will not elongate under working stress to exceed one fifteen-hundredth.

(c) Reinforcing steel used in reinforcing concrete construction shall not be painted, but shall be free from all mill scale and loose rust.

556. Cement Tests.) (a) Only Portland cement shall be used in reinforced concrete construction. All cement shall be tested in car load lots when delivered, or in quantities equal to the same. Cement failing to meet the requirements of accelerated test shall be rejected.

(b) Pats of neat cement must be allowed to harden twenty-four hours in moist air, and then be submitted to the accelerated test as follows: A pat is exposed in any convenient way in an atmosphere of steam, and above boiling water, in a loosely closed vessel for three hours, after which before the pat cools, it is placed in the boiling water for five additional hours. To pass this test satisfactorily, the pat shall remain firm and hard, and show no signs of cracking, distortion or disintegration.

(c) Portland cement when tested shall have a minimum tensile strength as follows: Neat cement after one day in moist air shall develop a tensile strength of at least 200 pounds per square inch; after one day in air and six days in water shall develop a tensile strength of at least 500 pounds per square inch, and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 600 pounds per square inch. Cement and sand tests composed of one part of cement and three parts of sand shall after one day in air and six days in water, develop a tensile strength of at least 175 pounds per square inch; and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 240 pounds per square inch.

(d) A certificate that the cement used has been tested and has met the requirements of this section and that the tests have been made in accordance with the

standard methods prescribed by the American Society for Testing Materials, on pages 119 to 164, both inclusive, of the proceedings of the Eleventh Annual Meeting of the American Society for Testing Materials, adopted August 15, 1908, shall be furnished by the architect or engineer in charge to the Commissioner of Buildings.

557. Sand.) The sand to be used for concrete shall be clean, hard, coarse sand, of the grade known as torpedo sand, and free from loam or dirt, not less than 45 per centum shall be returned on a screen of 400 mesh to the square inch.

558. Stone.) The stone to be used in concrete shall be clean crushed hard stone or clean crushed blast furnace slag or gravel of a size to pass through a one-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using. If slag is used, it shall be of such character that when made into concrete the concrete will develop a crushing strength equal to that specified for stone or gravel concrete.

559. Mixing.) All concrete shall be mixed in a mechanical mixer except when limited quantities are required, or when the conditions of the work make hand mixing preferable; hand mixing to be done only when approved by the Commissioner of Buildings. In all mixing, the separate ingredients shall be measured and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing.

560. Placing Concrete.) In filling in concrete around reinforcing steel, the concrete must be worked continuously with suitable tools, as it is put in place. Filling the forms completely and puddling afterward will not be permitted. In placing the concrete, the work shall be so laid out that partly set concrete will not be subjected to shocks from men wheeling or handling material over it.

561. Concrete Placed in Freezing Weather.) When concreting is carried on in freezing weather, the material must be heated, and such provisions made that the concrete can be put in place without freezing. The use of frozen, lumpy sand, or stone depending on hot water used in mixing to thaw it out will not be permitted. All reinforced concrete shall be kept at a temperature above freezing for at least forty-eight hours after being put in place. All forms under concrete placed in freezing weather shall remain until all evidences of frost are absent from the concrete and the natural hardening of the concrete has proceeded to the point of safety.

562. Concrete Placed in Warm Weather.) Concrete laid in warm weather shall be drenched with water twice daily, Sunday included, during the first week after being put in place.

563. Cement Finish.) Cement finish added to the top of slabs, beams, or girders, shall not be calculated in the strength of a member unless laid integrally with the rough concrete. No greater unit stress shall be allowed on such cement finish than on the rough concrete.

See Special Ruling IV, Page 170.

564. Fireproof Concrete Construction.) Reinforced concrete construction will be accepted for fireproof buildings if designed as prescribed in this paragraph. The aggregate for such concrete shall be clean, broken stone or clean crushed blast furnace slag, or clean screened gravel, together with clean, coarse sand of the grade known as torpedo sand; stone, slag or gravel shall be of a size to pass through a screen of three-quarter inch mesh. The minimum thickness of concrete surrounding the reinforcing members of reinforced concrete beams and gird-

ers shall be two inches on the bottom, and one and one-half inches on the sides of said beams and girders. The minimum thickness of concrete under slab rods shall be one inch; and all reinforcement in columns shall have a minimum protection of two inches of concrete except as hereinafter provided. If a supplementary metal fabric is placed in the concrete surrounding the reinforcing, simply for holding the concrete, the thickness of concrete under the reinforcing may be reduced by one-half inch, then such fabric shall not be considered as reinforcing metal.

565. Removal of Forms.) In no case shall the props and shores used in reinforced concrete construction be removed from under floors and roofs in less than two weeks, except as is provided herein. Column forms shall not be removed in less than four days. The centering from bottom of slabs and sides of beams and girders may be removed after the concrete has set for one week, if the floor has obtained sufficient hardness to sustain the dead weight of the said floor. No load or weight shall be placed on any portion of the construction until the concrete has fully set and the centers have been removed.

566. Tests.) The contractor for the reinforced concrete construction shall make load tests on any portion of the work within a reasonable time after erection, as may be required by the Commissioner of Buildings. Such tests must be made under the direction of the Commissioner of Buildings in his presence or in the presence of his representative, and must show that the construction will sustain a load twice the sum of the live and dead loads for which it was designed, without any sign of failure. The construction may be considered as part of the test load. Each test load shall cover two or more panels and shall remain in place at least twenty-four hours. The deflection under the full test load at the expiration of twenty-four hours shall not exceed one eight-hundredth of the span. These tests shall be considered as tests of workmanship only.

567. Reinforced Terra Cotta Hollow Tile.) (a) The term reinforced hollow tile is hereby defined to mean a system of hollow burned clay tile in combination with reinforced concrete, in which combination the hollow tile may be used to resist compressive and shearing stresses subject to the following provisions:

The provisions relating to reinforced concrete construction shall hold as far as applicable to this system.

All tile to be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having an ultimate compressive strength of not less than 4,000 pounds per square inch of net area of surface tested.

The following stresses and values shall not be exceeded: Extreme fibre stress (compressive) on hollow tile, 500 pounds per square inch.

Shearing stress on hollow tile, 200 pounds per square inch.

Adhesion between tile and 1:2:4 concrete to 1:3 cement mortar, 40 pounds per square inch.

Ratio of modulus of elasticity of steel to that of tile with cement mortar joints, 10.

(b) **Special Provisions as to Workmanship in Reinforced Hollow Tile Construction.)** The hollow tile shall be thoroughly soaked with water at the time concrete is poured and be kept drenched for at least thirty-six hours afterwards. The joints between tiles shall be staggered, buttered and slushed full of mortar consisting of one (1) part of Portland cement and three (3) parts of clean, sharp sand, thoroughly mixed.

(c) **Terra Cotta Tile Columns.)** Columns of solid terra cotta or of hollow terra cotta in which the sectional area of the open holes in each block shall not exceed twenty (20) per cent of the gross sectional area of such block, may be used for structural purposes provided the height of such column shall not exceed twelve times the least dimension.

The allowable stress shall not exceed 350 pounds per square inch and shall be subject to the reduction formula given in Section 553 in paragraph f.

All terra cotta tile used for construction of columns shall be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having ultimate compressive strength of not less than 6,000 pounds per square inch of net area of cross section of samples tested.

Mortar used in setting terra cotta tile walls and columns to be composed of one (1) part Portland cement and three (3) parts clean, sharp sand, thoroughly mixed.

(d) **Special Provisions as to Workmanship in Tile Column Construction.)** All terra cotta tile must be thoroughly wet before using and when used in columns must be set on end with the voids running vertically and directly over each other, and with the webs in direct line of pressure.

All vertical joints must stagger and terra cotta blocks must be of proper dimensions to meet this condition as no broken tile will be allowed.

All work to be set plumb, with uniform horizontal joints, thickness to average three-eighths (3/8) of an inch. The minimum time which shall elapse between the finishing of the work and before any load is placed thereon shall be not less than seven days.

(e) **Terra Cotta Tile Walls.)** Hollow tile may be used for building primary bearing walls, which are defined as walls that may be used to receive directly the loads from floors or roofs in addition to their acting as partition walls, provided the proportion between thickness of wall and free height between the floors does not exceed fifteen (15) and the load including the weight of the construction does not exceed three hundred and fifty (350) pounds per square inch of net sectional area of tile, and shall be of the thickness specified by this chapter for brick walls. Hollow terra cotta tile may be used for exterior walls, but when so used the thickness and height of the work must conform to the dimensions required for brick walls in this chapter, but must in no case exceed four stories in height in any building. The thickness of walls shall be calculated as the outside dimensions of the tile and each tile shall be full thickness of wall. The thickness of the plastering is not to be included as a part of the thickness of the wall. Walls having a thickness of 4 inches may be used when the height does not exceed five (5) feet. The quality of the tile and mortar and special provisions as to workmanship as specified for terra cotta columns shall apply to terra cotta tile walls.

(f) **Terra Cotta Grain Bin Construction.)** Fireproof storage bin, grain elevators and grain warehouses may be built in cylindrical form with terra cotta tile of such height, diameter and thickness as is allowed by safe engineering practices, provided that the material shall not be stressed in excess of the limits prescribed in this chapter for walls and columns.

568. **Cinder Concrete.)** (a) Cinder concrete construction may be used for all buildings in which fireproof construction is mandatory by this chapter, or where ordinary construction, mill construction or slow-burning construction may be used.

(b) Only clean, thoroughly burnt, steam boiler cinders, free from matter other than cinders may be used. The cinders used shall

be of such size that they will pass through a one-inch square mesh. Cinder concrete piers or walls shall not be permitted to carry loads and shall not be given credit therefor.

(c) The ultimate compressive strength per square inch of cinder concrete shall be taken as not exceeding seven hundred pounds. The ratio of the modulus of elasticity of steel divided by the modulus of elasticity of cinder concrete shall be taken as thirty.

(d) There shall not be less than one part of Portland cement to seven parts of cinders and sand of the grade known as torpedo sand in cinder concrete. All other special requirements and methods of calculation for reinforced concrete as required in this chapter shall modify and regulate the use of cinder concrete in buildings.

(e) All steel and all metal pipe and conduits enclosed in cinder concrete shall be protected by a coating of cement grout or plastered with good lime mortar before the cinder concrete is placed.

(f) For fireproof construction, the minimum thickness of cinder concrete covering on structural metal shall be the same as required for brick or concrete covering for fireproof buildings by this chapter. In slow-burning or mill construction buildings, the minimum thickness of cinder concrete covering on structural metal shall be three inches on columns and two inches on beams, girders and other structural steel or iron members.

(g) Wherever cinder concrete is used for the covering of columns, beams, girders or other structural steel members of a building the cinder concrete covering shall have metal binders, or wire fabric, imbedded in and around said columns, beams, girders or other structural steel members. If wire is used for said metal binders, it shall not be smaller than No. 8 gauge wire and shall be spaced not less than sixteen inches apart along the length of the steel member covered.

(h) Where cinder concrete construction is used for a building which, by this chapter, is required to be of fireproof construction, all parts that carry weights or resist strains, shall be made entirely of incombustible material, and all metallic structural members shall be protected against the effects of fire by cinder concrete proportioned, mixed, applied and secured as herein described.

(i) All other parts of a building of cinder concrete construction, built where fireproof construction is mandatory by this chapter, shall be built and made of the material required by this chapter for buildings of fireproof construction; provided, however, that cinder concrete as described herein, and of the same thickness elsewhere specified, may be used for all protective covering of structural metal, after such metal has been protected by a coating of cement grout or plastered with good lime mortar, as required by this chapter.

Skeleton Construction.

See Special Ruling I, Page 194.

569. **Skeleton Construction.)** (a) The term "Skeleton Construction" shall apply to all buildings wherein all external and internal loads and stresses are transmitted from the top of the building to the foundations by a skeleton or framework of metal or reinforced concrete.

(b) In metal frame skeleton construction the beams and girders shall be riveted to each other at their respective junction points. If columns made of rolled iron or steel are used, their different parts shall be riveted to each other, and the beams and girders shall have riveted connections to unite them with the columns. If cast iron

columns are used, each successive column shall be bolted to the one below it by at least four bolts not less than $\frac{3}{4}$ inch in diameter, and the beams and girders shall be bolted to the columns. Bolt holes in flanges for connection from column to column shall be drilled. At each line of floor or roof beams, lateral connections between the ends of the beams and girders shall be made in such manner as to rigidly connect the beams and girders with each other in the direction of their length.

(c) All steel trusses shall be riveted and the steel work in buildings more than 100 feet high and in a building whose height exceeds twice its width shall be riveted.

(d) Wherever it is found impossible to rivet connections as herein described and such connections are bolted, cold rolled or turned bolts of exact fit and diameter in reamed holes may be used in place of rivets with the same allowable stresses as field driven rivets.

(e) All structural members which are temporarily bolted together shall be well bolted in every alternate hole.

(f) After the bases or base plates and columns have been set in place, both shall be protected by a covering of cement concrete applied direct to the metal, measuring not less than two and one-half inches thick from the extreme projection of the metal, filled solid into all spaces, and forming a continuous concrete mass from the grillage or other foundations on an elevation six feet above the floor level nearest the column base plate or column stool.

(g) All metal shall be clean and shall be free from loose rust and scale, and all metal except that to be embedded in concrete shall be protected with at least two coats of metal protecting paint.

(h) All structural details and workmanship shall be in accordance with accepted engineering practice.

(i) All trusses shall be held rigidly in position, both temporarily and permanently by efficient lateral and sway bracing.

Miscellaneous Provisions.

570. Porches—Verandas—Porticos—Construction of Inside Fire Limits. (a) The enclosing walls of porches, verandas, or porticos shall be of incombustible material on buildings inside the fire limits, except that where such porches, verandas, or porticos constitute part of a storm house or of a storm door enclosure, they may be of combustible material, providing, that they be not more than twelve feet high, nor occupy a greater frontage than two feet more than the width of the inner doors protected by such storm enclosure.

(b) On buildings more than three stories in height, porches hereafter erected, if of combustible material, shall not exceed one story in height. Where porches of incombustible material are continuous and extend fifty feet or more across the rear of buildings, there shall be a partition of incombustible material separating each fifty feet of porch from the adjacent porch.

571. Tanks on Roofs—Permits—Fees. (a) It shall be unlawful for any person, firm or corporation to construct, maintain or allow, or permit to remain in or upon the roof of any building in the city, any tank of a larger capacity than four hundred gallons, unless such tank shall rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron girders set on steel plates which rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron or steel construction. No tank of a capacity exceeding four hundred gallons shall be constructed in or upon any building without first submitting for the approval of the Commissioner of Buildings a complete set of plans, showing the con-

struction in detail of the supports and foundations of such tank. If such plans shall be satisfactory to the Commissioner of Buildings, they shall be approved by him. The owner or his agent or the contractor erecting such tank shall, before proceeding with the erection of such tank, procure from the Department of Buildings a permit for the sub-structure work, for which permit a fee of five dollars shall be charged.

572. Door and Window Openings, When Protected in Buildings of Classes I, II, IV, V, VII and VIII—Iron Doors—Wired Glass Set in Metal Frames. (a) Where the distance from door to window openings in buildings of Classes I, II, IV, V, VII and VIII is less than thirty (30) feet from the opposite side of the established alley line and where the windows and doors of two or more areas of the same building which is required to be separated by dividing walls by this chapter, are on a court, every such window and door, distant less than thirty feet from another window or door of another such area and where also the doors and window openings are within fifteen (15) feet of an inside lot line, such openings shall be provided with windows and doors constructed of wire glass set in metal frames and sash; provided, further, that doors may be automatic rolling steel shutters or steel plate doors or metal-clad wood doors, and further provided that at least one of the first or ground floor doors must be a swinging door.

(b) Where iron doors are used to fulfill the requirements of this section they shall be made of sheet iron or steel, of not less than No. 14 U. S. gauge metal, and shall lap the wall at least one-half inch all around the opening, and the bottom shall fit the sill closely where it is not practicable to lap it. The frames and crossbars shall be made of one and one-half by one and one-half by one-fourth inch angles and in no case shall there be less than two crossbars, and where the doors are over six feet high, such crossbars shall be spaced not more than two feet apart. Lever bars shall be made of one and one-half by three-eighths inch iron, extending at least one-third of the distance across the opposite leaf. The number and spacing of such lever bars shall be the same as the crossbars. Where hinges are used they shall be made of two by one-fourth inch iron, extending at least three-fourths of the way across the door. The number and spacing of such hinges shall be the same as is required for the crossbars. Pin bolt or eyes shall be one-half inch round and shall be securely fastened to the building.

(c) Where metal frames and wired glass are used to fulfill the requirements of this section, the glazed portion of the frames and sash shall be set with fire-resisting glass such as is elsewhere herein defined. The unsupported area of the glass shall be in neither width nor length greater than forty-eight inches or exceed seven hundred and twenty (720) square inches in any one pane of glass. The glass must be supported by frames and sashes. The wired glass shall be retained by the structural part of the frame or sash independently of material used for waterproof purposes and only non-inflammable material shall be used in setting glass in the sash. Frames shall be of such form as to be retained by the walls either with flanges of at least one inch in width or by hooks of proper length securely driven into the wall or by means of extending wings flush with the brickwork and securely spiked to the wall. Frames shall be made of galvanized iron of not less than No. 24 gauge metal, and of a quality soft enough to permit all necessary bending without breaking, or they may also be constructed of not less than 20-ounce copper, or other metal of equal strength and durability and

which will not melt at a lower temperature than copper. All joints shall be made with interlocking seams. They shall be securely riveted together, and in no case, shall solder be used. Grooves and rabbets shall be at least three-quarters of an inch in depth and the actual bearing of the glass shall be at least five-eighths of an inch. The head of the frame shall be closed at the top and the piece forming this closure shall be securely fastened to each side at all points. The sill shall be filled with concrete or other noncombustible material. Movable sash shall have stiles and rails of the thickness and width of at least one and three-quarters inches and shall be securely fastened together at each corner and so constructed that they will correspond in construction with the frame at the point of contact.

(d) Lifting or sliding sash shall be counterweighted so as to balance. The sash weights shall be properly separated by parting strips in the boxes containing them, and shall be accessible through the jambs of the frame. Such sash shall be provided with metallic sash chain or cable and smooth running sash pulleys securely riveted or bolted in place. The sash chain or cable shall be of sufficient strength to withstand severe heat without parting, and be thoroughly protected against moisture and corrosion. The sash shall be fitted into the frame with suitable stops and parting beads of metal. Sash shall be removable. Meeting rails of the sash shall be so constructed as to prevent the passage of heat and flame. The sash shall be equipped with one or more substantial sash locks securely riveted or bolted in place.

(e) Horizontally pivoted sash shall be riveted above the center on steel pivots at least three-eighths inch in diameter. Pivots shall work in brass eye plates securely riveted in place. Frames shall be reinforced where the pivots enter by riveting on one-eighth inch iron strips, so drilled as to receive the pivots. Such sash must be provided with suitable stops and an effective attachment for holding them open or closed. Such sash shall be provided with a substantial gravity lock or latch at top and bottom which will be positive in action. Where the lower sash is stationary or where two pivoted sash are used the transom bar dividing the upper from the lower sash shall be so constructed that it will not warp or bulge materially under heat or rapid cooling. Where rails and transoms are used they shall be made so as not to be easily affected by rust and so as to afford ample weatherproof qualities.

(f) Vertically pivoted sash shall comply generally with the requirements for horizontally pivoted sash. If the entire window is pivoted in one sash, such sash must be constructed in such manner as to afford stiffness, and in such manner as to prevent warping under heat.

(g) Hinge sash or casement windows must be hinged with heavy brass hinges and a substantial brass latch or lock securely bolted in place. Such sash shall be constructed so as to fit the frame closely and afford ample weatherproof qualities at all points. They shall be provided with stops and fastenings necessary to prevent warping under heat.

(h) Where the area of wall openings is in excess of 5 by 9 feet, the metal frames containing the sash or glass must be reinforced at every point of division by not less than five-inch "I" beams securely fastened into the brickwork, proper allowance being made for expansion of the beams when heated. "I" beams shall be protected on the flanges with at least two inches of tile, concrete, or other material approved by the Commissioner of Buildings, and next to the web with at least two and one-half inches

of such material, which thickness shall be increased on large beams. Metal frames shall be securely attached to the reinforcing members.

(i) Electro-glazed prism glass may be used in lieu of wired glass, when approved by the Commissioner of Buildings as to material and construction of same, providing the frames and sash of same comply with the requirements of this section for wired glass window frames and sash.

(j) This section shall not apply to frame buildings nor to buildings outside the fire limits twenty-eight hundred square feet or less in area, nor to buildings of Class I, one story in height, nor to buildings of Class II not more than two stories in height, nor to store windows in the first story, where the same are located on an alley and not more than sixteen feet from the street.

***573. Dividing Walls and Iron Doors—Openings Inserted.)** (a) *Wherever openings are to be inserted in dividing walls in buildings, where such dividing walls are required by reason of the large area of such building, or in dividing walls between two or more connected or attached buildings, they shall be provided with incombustible doors as follows:*

(b) Such doors may be either sliding doors or swinging doors, and shall be so constructed, installed and maintained that they can be easily opened or closed from either side at all times by any person; provided, however, rolling steel shutters may be used when such openings are not used as exits.

(c) Every such door shall be equipped with a device containing a fusible link or other releasing arrangement of equal efficiency, approved by the Commissioner of Buildings. There shall be one of these immediately above the door opening and one above the opening near the ceiling. Where the ceiling is less than three feet above the door opening, the last mentioned fusible link or releasing device may be omitted, if the doors are so arranged that the operation of any one of the thermostats, or other releasing devices, will result in the closing of the doors on both sides of the walls. Fusible links, or other approved substitute, shall be made so that they will fuse or operate when subjected to a heat of 160 to 165 degrees Fahrenheit. If said doors are of steel plate, the plate or plates shall be of No. 12 U. S. gauge or greater thickness, with a continuous two by two by three-eighths inch angle iron frame extending all around the same and two by two by three-eighths inch panel bars not exceeding twenty-four inches apart, riveted to the plate of the door with not less than three-eighths inch rivets spaced four inches to six inches between centers. Pairs of swinging doors shall be so constructed that when the doors are closed, they will be of strength equal to that of a single door, and shall be so arranged that they will operate automatically. All doors shall be hung on wall frames of four by three by three-eighths inch angle iron or of four by three-eighths inch bar iron stiffened by one and one-half by one and one-half by one-fourth inch angles riveted on the back and fitting snugly to the wall. The frame shall be fastened together by three-fourths inch bolts extending through the wall, such bolts being not more than two feet apart. All doors to be made to fit closely to the wall frame on all sides. Lintels of door openings shall be made of brick, iron or concrete.

(d) Swinging iron doors shall swing on three wrought iron hinges made of two by three-eighths inch bar iron and shall be secured by at least three lever bars of one and one-half by three-eighths inch iron, working together and so arranged as to be operated on either side of the door.

(e) Sliding iron doors shall slide in channels at the top and bottom; bottom channels shall be formed by two angles two and one-half by three-eighths inch and one and one-half by one-fourth inch; top channels to be formed by two angles two by three-eighths inch and one and one-half by one-fourth inch; channels shall be securely riveted or bolted through the wall frame and where they extend beyond the wall frame shall be firmly bolted to the wall by expansion bolts. Track shall be without incline, of one-half by one-half inch iron securely riveted on the upper side of the angle iron channel. Hangers shall be of the anti-friction pattern and securely fastened to the door plate by at least four one-half inch bolts. Wheels shall be of cast iron three-fourths by four and one-half inches.

(f) Sills between iron doors shall be of one-fourth inch iron or steel with edges securely fastened to one and one-half by one and one-half by one-fourth inch angle iron or heavier, on the inner side of the wall frame. Where adjoining floors are of concrete construction, sill plates may be omitted.

(g) When tin-clad doors are used they shall be made of three thicknesses of thirteen-sixteenths inch seasoned, non-resinous wood, of good sound quality, free from sap and large or loose knots, tongued and grooved, dressed on both sides and not exceeding eight inches in width. The outside layers shall be vertical, the inside layer shall be horizontal; layers shall be securely fastened together by wrought iron clinch nails driven in flush and clinched so as to leave smooth surfaces. The woodwork shall be thoroughly covered with terne plate tin of size fourteen by twenty inches, weighing not less than one hundred and thirteen pounds per box of one hundred and twelve sheets; all joints shall be locked one-half inch and nailed under seams, except on edges of door; vertical joints shall be double locked, horizontal joints single locked. Nails used to fasten tin shall be No. 13 gauge, flat head, full barbed wire, two inches long.

(h) Swinging tin-clad doors shall have three-eighths by two and one-half inch wrought iron hinges bolted to doors with four three-eighths inch bolts. Doors in excess of seven feet in height shall be provided with three hinges and have wrought iron wall eyes built in wall, or riveted to wall frame, or bolted through wall with three-fourth inch bolts. They shall have at least three level bars of one and one-half by three-eighths inch iron working together; the latch shall be placed so it can be operated from either side of the door and provided with proper keepers bolted through the door, with the spring to insure latching; catches shall be made of one-half inch wrought iron securely bolted to wall or wall frame.

(i) Sliding tin-clad doors shall have tracks inclined three-fourths inch to the foot, made of three and one-half by three-eighths inch rolled steel, or round bars, or round pipes of equal strength, securely bolted through wall with three-fourths inch bolts. Hangers shall be made of three-eighths by three and one-half inch wrought iron attached by not less than one-inch bolts. Wheels shall be of malleable or wrought iron with not less than one and one-half inches bearing on axle. Doors over six feet wide shall have three hangers and shall be provided with necessary binders, chafing strips, bumpers and bumper shoes.

(j) Sills between tin-clad doors shall be of one-fourth inch iron or steel riveted to a three and one-half by five by three-eighths inch angle iron on each side of the

wall; angle irons to be fastened together through the wall by three-fourths inch bolts spaced not to exceed eighteen inches apart; provided, that where adjoining floors are of concrete construction, sill plates may be omitted.

(k) Rolling steel doors used as dividing wall doors shall be made either of wooden slats covered with steel or bronze, or of number 20 U. S. gauge painted steel, or of number 21 U. S. gauge galvanized steel. The edges of such doors shall run in steel channels not less than one and one-half inches deep, and three-sixteenths of an inch in thickness.

(l) Such doors shall be hung on winding shafts and helical springs of sufficient strength to counterbalance the door at any position, and shall be equipped with a device to hold the doors in a closed position if the spring is destroyed. The head of the door opening shall have baffle plates of number 12 U. S. gauge steel, which shall be reinforced around the edges by one and one-half inch angles, to act as fire and smoke stops. The openings for such doors shall have steel frames and sills as herein required for steel swinging doors.

(m) Wherever incombustible doors are to be used in openings to vertical shafts for stairways, passenger and freight elevators, pipes, conduits, and in corridor and room partitions, they may be made of two thicknesses of wood and covered with tin as described in paragraph (g) of this section, or of No. 20 U. S. gauge steel with stiles and rails not less than one and three-fourths inch and panels one-quarter inch thick, and the interior of said doors shall be filled with asbestos or non-resinous wood, provided further, that in fireproof buildings of Classes IIa, IIb, III, except when used in part as a stable or garage, IV, V, and VIII, and in fireproof buildings of Class I, when equipped with an automatic sprinkler system, and when the occupancy does not constitute a special fire hazard in the opinion of the Chief of Fire Prevention and Public Safety, these openings, with the exception of openings to freight elevators, may be provided with incombustible doors consisting of a structure of clear, non-resinous wood not less than one and three-eighths inch thick assembled in the form of a core and protected on all surfaces with a pure, long fibre asbestos fabric, weighing one and twenty-eight one-hundredths ounces per square foot, or other protective coating equally as incombustible and mechanically bonded therewith and veneered, or consisting of a structure of clear, non-resinous wood with panels not less than three-quarters inch thick and stiles and rails not less than one and three-eighths inch thick assembled in the form of a core and covered on all surfaces with an asbestos fabric and sheet steel, copper, or bronze, provided further, that nothing contained in this paragraph shall be construed as prohibiting the use of such incombustible doors as are described in paragraphs (e), (g) and (k) of this section and paragraph (b) of Section 52. The frames and trim shall be of materials as herein described.

(n) No glass panels shall be permitted in incombustible doors, except that in fireproof buildings of Classes I, IIa, IIb, III, except when used in part as a stable or garage, IV, V and VIII, doors to passenger elevators, stairs, halls, courts, fire escapes, corridor and room partitions, wired glass panels may be used not exceeding one thousand four hundred forty square inches in total area, no division of which shall exceed 720 square inches in area and no dimension of which shall exceed forty-eight inches in extent. Where an elevator or stairway is enclosed with incombustible partitions and doors for the purpose of obtaining credit for additional exits, no glass of any kind shall be permitted in these partitions or doors.

Paragraph (a) amended, and paragraphs (m) and (n) added, April 8, 1915.

571. Metal or Reinforced Concrete Chimneys in Fireproof Buildings—(Air Space.)
(a) Internal chimneys of rolled steel or iron may be built in buildings of fireproof construction, provided that the rolled steel shall be not less than three-eighths inch in

thickness, except that the upper fifty feet of such chimney may be one-quarter of an inch in thickness, riveted in every joint, or of cast iron, providing same shall not be less than three-fourths inch in thickness and jointed by bell and spigot joints or flanged bolted joints. All joints in cast iron work shall be filled and pointed with fire clay. Such metal internal chimneys shall be securely and firmly anchored to the framing of such fireproof building at each floor line and at the roof. The lower part of each such chimney shall be lined with insulating lining for a height herein required for the respective area by Section 645 of this Chapter. The insulating lining shall be one of the linings described in Section 580 of this Chapter.

(b) Reinforced concrete not less than four inches in thickness may be used on the interior of fireproof buildings, provided the requirements for reinforced concrete and for reinforced concrete stacks elsewhere required by this Chapter shall be complied with.

(c) Internal metal or re-inforced concrete stacks on fireproof buildings shall be surrounded by continuous air space from the lowest story through the roof not less than four inches across at any point, and said air space shall be surrounded by brick, hollow tile, or reinforced concrete. No structural metal in such air space shall be without such fireproof covering.

575. Reinforced Concrete Chimneys—How Built.) Reinforced concrete chimneys in which the temperature of the gases is intended to exceed 750 degrees Fahrenheit, shall be lined with fire brick or magnesia or asbestos insulating lining for the height and in the manner elsewhere required by this Chapter. If the insulating is stopped anywhere below the top of a reinforced concrete chimney or if the cross section of such a chimney is changed, then the reinforcing shall be increased at such points sufficiently to prevent the formation of temperature cracks.

576. Tenement and Apartment House Boiler Chimneys.) Chimneys for the heating apparatus of tenement and apartment houses shall not be considered as flues used for domestic purposes.

577. Height of Chimneys Above Roof.) (a) The height of all chimneys and flues of stoves used for domestic purposes or open fireplaces shall be not less than five feet higher than the highest point of the roof of the building of which they are a part.

(b) The height of all chimneys and flues above the highest portion of the roof of which they are a part, where such chimneys or flues are used for other than domestic purposes or for open fireplaces, shall be determined by dividing the greatest diameter in inches by four, and the quotient thereby obtained in terms of feet, with five feet added, shall be the minimum height from the tops of such chimneys and flues above the highest portion of roof of the building. In no case shall the height of any chimney or flue be less than five feet above the roof of the building of which it is a part.

(c) The sum of the horizontal distance of any wood tank, pent house or roof house, on the same building of which any chimney shall be a part, and the vertical distance of top of such wood tank, pent house, or roof house, on the same building to a horizontal plane passed through the top of the chimney shall not be less than one and one-half times the required height of the top of the chimney above the roof. The tops of chimneys within a radius of twenty-five feet of any wood tank, pent house, or roof house, on the same building of which such chimney shall be a part shall be at least as high

as the top of said wood tank, pent house, or roof house. The tops of chimneys on ridge roofs shall be not less than three feet above the ridge.

578. Insulating Cavities—Where Required.) All flues having a greater area than four hundred square inches shall be lined on the inside with an insulating material, which lining shall start at least two feet below the smoke inlet and shall extend upwards for at least ten times the diameter of the flue, or if said flue is not circular or square in cross section for ten times the average diameter, when the flues are of brick, stone or concrete, said insulating lining shall be fire clay brick or fire clay blocks, and if such bricks or blocks are four inches or more in thickness, they may be considered as a portion of the thickness required for the surrounding walls. The walls surrounding chimneys having an area greater than four hundred square inches shall have an insulating cavity not less than three inches wide surrounding the inner four inches of fire brick or fire clay blocks, for not less than the height required above for insulating lining and said inner core shall be built independent of the surrounding brick work and shall be free to expand or contract.

579. Metal Chimneys in Buildings of Ordinary Slow-Burning or Mill Construction.) Interior stacks or smoke flues of metal shall not be used in buildings of ordinary or slow burning or mill construction, unless they are surrounded by self-supporting brick or re-inforced concrete walls of the thickness herein required for flues of the respective area; provided, however, that if an interior smoke pipe of steel of not less than three-eighths inch in thickness riveted in every joint, or an interior smoke pipe of cast iron not less than five-eighths inch in thickness is used, then the brick work required inside of the insulating cavity of a stack may be omitted, but such metal linings shall be lined with such insulating material for the height herein elsewhere required for stacks. If a chimney or stack is not a part of the walls of such a building, it shall be designed as an isolated chimney as required by Section 583 of this chapter.

580. Insulating Material for Metal Chimneys and Metal Stacks.) (a) Fire clay brick or fire clay blocks may be used for the insulating lining of metal chimneys and stacks but not of a lesser thickness than two inches. The material shall be increased in thickness or supported on structural steel ledges and the material shall be stressed not to exceed the safe limits of stress elsewhere herein fixed for the material, or metal chimneys and metal stacks may be lined with blocks of magnesia insulation or with fused asbestos board insulation, or metal stacks or chimneys may be lined with any other insulating material tested and approved by the Commissioner of Buildings.

(b) Magnesia block insulation shall contain not less than 15 per cent of magnesia and 50 per cent asbestos fibre formed into blocks not less than 1½ inches in thickness by hydraulic pressure. After said magnesia blocks have been set, they and all metal bands and ties exposed with the flue shall be plastered with cement not less than one-half inch in thickness on one and one-half inch blocks, and one-fourth inch in thickness on one and three-fourths inch and thicker blocks.

(c) Fused asbestos board shall be made of alternate flat and corrugated sheets of asbestos board, cemented together and fused under a heat of not less than 1,000 degrees Fahrenheit to a minimum thickness of 1¼ inches. After said fused asbestos boards have been set into the flues, they and all

exposed metal bands or ties shall be pointed with cement.

(d) Such magnesia blocks, fused asbestos boards, pointing cement and any other insulating material approved by the Commissioner of Buildings shall resist the disintegrating, dissolving, or diminishing action of moist steam and the acid and gaseous fumes present in the flue at any degree of heat obtainable by the combustion of the fuel used.

581. Chimneys — Interior — Framing Around.) In case of chimneys which are enclosed, or form part of the interior of any building, no joists or girders shall rest or be supported on the walls of such chimney, and the framing around chimneys of all kinds shall be so constructed that in no case will any joists or timbers be placed nearer than two inches from the outside face of walls of flues, and in no case shall the distance from the inside of any flue to any joists or timbers be less than seven inches.

582. Chimneys—External Location of.) (a) Chimneys built outside of the walls of buildings shall not encroach upon any street or alley, and shall be built as follows:

(b) If at least one side of such chimney abuts entirely upon the wall of an existing building and the chimney is throughout its entire length securely and firmly anchored to the walls of such existing building, the wall of such chimney may be built of hollow tiles, in which case, however, it shall have a cast iron base, lined with fire brick, extending to a height of at least ten feet above the street or alley grade.

583. Chimneys—Isolated—Walls Surrounding Smoke Flues.) Isolated chimneys shall be so designed and constructed that the stress in every part thereof, due to the weight of the stack itself and from wind pressure, shall not exceed the safe limits as provided in this Chapter for the material used.

***584. Walls Forming Smoke Flues.)** The walls forming smoke flues of one hundred and forty-four square inches area or less shall be of brick, concrete, stone, or of any one of these and burnt fire-clay flue tile lining, and such flue linings shall extend from the first opening to a distance of at least two feet above the roof joints. If only one of the above materials is used it shall not be less than eight inches in thickness. Provided, however, that such flues having walls at least three inches in thickness of continuous concrete or interlocking or rabbited joint concrete sectional flues may be used without burnt fire-clay flue tile linings. If any one of the above materials is used in combination with burnt fire-clay tile flue lining it shall be not less than four inches in thickness, and the burnt fire-clay flue lining shall be not less than three-fourths inches in thickness, and built as herein described. The walls forming smoke flues of more than one hundred and forty-four square inches area and not more than three hundred square inches area shall be of brick, concrete, stone, or any one of these and burnt fire-clay flue tile lining. If any of the above materials is used alone, it shall be not less than thirteen inches in thickness. If any one is used in combination with burnt clay flue tile lining, it shall be not less than nine inches in thickness and the fire-clay flue tile lining shall be not less than three-fourths inch in thickness and built as herein required. The walls forming flues having an area greater than three hundred square inches and less than six hundred square inches shall be built of one of the materials described above not less than twelve inches in thickness, and flues having an area greater than six hundred square inches shall have walls of one of the materials described above not

less than sixteen inches in thickness, and these walls may be reduced to twelve inches in thickness at a point not less than fifty feet above the top of the breeching; provided, however, that the material of which all chimneys are constructed shall be so proportioned that it will not be subjected to a greater stress than elsewhere herein fixed as the maximum safe stress for such material. *Amended February 20, 1911.

585. Ventilating Ducts — Chutes — Walls Forming.) Walls forming ventilating ducts and rubbish and ash chutes shall be constructed in accordance with the regulations governing the construction of smoke flues elsewhere herein contained. Walls forming ventilating ducts shall not be less than four inches thick, and when the ventilating duct is larger than two hundred and sixty square inches the walls shall be not less than eight inches thick.

586. Smoke Pipes Passing Through Partitions—Woodwork Around.) (a) Where smoke pipes of diameter of six inches or less pass horizontally through a wood or a plastered stud partition, they shall be surrounded by a ventilated thimble of incombustible material with a diameter at least twelve inches greater than the diameter of the pipe.

(b) Where a smoke pipe of a greater diameter than six inches passes through a wood or plastered stud partition, it shall be surrounded either by a body of brick, hollow tile, porous terra cotta or other incombustible substance, measuring at least eight inches all around such smoke pipe. Smoke pipes of less diameter than twelve inches shall be kept at least twelve inches distant from any combustible partition, ceiling or floor, and such woodwork immediately over and for a distance of two feet on each side of such smoke pipe shall be covered with sheet metal or with porous terra cotta, hollow tile or plaster.

(c) Smoke pipes of greater diameter than twelve inches and less area than six square feet, shall be kept at least twenty inches away from any woodwork. Such woodwork shall be protected as above specified for smaller smoke pipes to a distance of four feet on each side of such smoke pipe; provided, that in case of low pressure boilers used for heating purposes only, the distance from a smoke pipe to any woodwork shall not be less than two feet.

(d) Whenever smoke pipes of larger area than six square feet are used, they shall be kept at least three feet distant from any woodwork, and such woodwork for a distance of at least six feet on either side of such smoke pipes shall be protected as before specified for smaller pipes.

587. Floors—Protection of—Around Boilers, Furnaces, Etc.) Wherever steam boilers, furnaces, ovens, coffee roasters, or other structures in which fires are maintained, except stoves for domestic purposes standing on legs and affording not less than four inches air space, are set inside of a building, the floors under the same if not already fireproof, shall be taken out and replaced by a floor of fireproof material extending not less than six feet in each direction from the boiler or such other appliances.

588. Ceiling—Protection of—Around Boilers, Furnaces, Etc.) The space between the tops of all steam boilers and furnaces and any wood ceiling construction shall in no case be less than three feet, unless such boiler carry not more than ten pounds pressure, in which case such space shall be not less than eighteen inches. All wood sheathing, wood laths or other combustible ceiling finish, shall be removed from above and for a space of two feet on all sides of such boilers and smoke pipes and the ceiling given at least two coats of whitewash or

fire-retarding paint, and the top of such boilers and the top and sides of such smoke pipes shall be covered with at least three inches of asbestos cement or two inches of eighty-five percent magnesia and an outer covering of one-half inch asbestos cement, or such equivalent protection as may be approved by the Commissioner of Buildings; or the under side of such wood ceiling construction over the boiler or furnace and also over the smoke pipe leading from same and extending at least two feet in each direction beyond the boiler or furnace and smoke pipe shall be protected either by three coats of plastering on metallic lath or wire netting, or at least two inches of porous terra cotta or hollow tile covered on the under side with a heavy coat of plaster. If metal is used in the construction of smoke-pipes, such metal shall be of thickness not less than No. 14 U. S. gauge.

589. Boilers—Location of—Permit for.) In all cases, boilers shall be so placed as to give ample room between any ceiling, wall or partition to connect or operate any valves or pipes or other connections used on such steam boilers. The size, number and location of boilers to be installed in any building shall be marked on the plans and, except in buildings of Class III, approved by the Department of Smoke Inspection of Steam Boilers and Steam Plants, and by the Department of Smoke Inspection, before a permit is issued by the Department of Buildings for the erection of such building.

590. Cupolas of Foundries.) Cupolas of foundries shall extend at least twenty-five feet above the highest point of any roof within a radius of forty feet of such cupola.

591. Cornices—Eaves—Gutters—Pipes from Roof.) (a) No wood shall be used for any purpose in connection with cornices, eaves and external gutters on any building more than fifty feet in height. The entire exterior covering of cornices and eaves of buildings hereafter to be erected within the fire limits shall be of incombustible material.

(b) Wherever sheet metal cornices or eaves or external gutters are used, their entire exterior covering shall be of metal or other incombustible material approved by the Commissioner of Buildings. Bracket supports for same shall be firmly secured to the wall at least every four feet, and the walls shall be carried full height under and behind same throughout their entire length.

(c) The water from all roofs shall be carried to the sewer in metal conductor pipes. Every such conductor shall be continually maintained in good condition, and if such conductors are within the exterior walls, they shall be of screwed-joint iron or steel pipe, or of cast iron pipe with calked joints.

592. Towers, Domes and Spires—Construction of.) Towers, domes and spires may be built on top of the roofs of buildings, but shall not occupy more than one-quarter of the street frontage of any building. Such towers, domes, or spires, if any part thereof is built to a height of more than fifty feet and less than ninety feet, shall be of slow-burning construction, and, if of a greater height than ninety feet above the sidewalk, shall be of fireproof construction; and, in all cases where the area of such tower, dome, or spire exceeds one hundred square feet, its supports shall be carried down to the ground, and shall be, if the structure supported is more than fifty feet and less than ninety feet high, of slow-burning construction, and, if more than ninety feet high, of fireproof construction. No tower, dome, or spire shall exceed thirty-six hundred (3,600) square feet in area, and in no case shall the area exceed fifteen per cent of the total area of the building on which it is erected, nor shall the height of

any tower, dome or spire exceed four hundred feet measured from the established inside grade.

***592a. Structures—Construction and Limitations of.)** All structures built within the City other than those otherwise specifically provided for herein shall be designed and constructed according to established engineering practice, and shall comply with the provisions of this section. No structure of frame or mill construction within the fire limits shall exceed 35 feet in height from the ground to the highest point thereof. No structure of mill or frame construction outside the fire limits shall exceed the height of 45 feet from the ground to the highest point thereof.

*All structures over thirty-five feet in height within the fire limits, and all structures over forty-five feet in height outside the fire limits shall be built of structural steel, concrete or masonry; *provided, however, that viaducts or runways to be used for the purpose of transferring livestock from one building or place to another may be built of wood not to exceed eighty feet in height either within or without the fire limits.*

*Amended July 22, 1912.

If it is desired to enclose any structure, such structure shall be enclosed with concrete or masonry walls, or incombustible material of such construction as shall be approved by the Commissioner of Buildings; provided that structures outside the fire limits not exceeding 2,800 square feet in area, or 45 feet in height, may be enclosed with combustible material.

In every structure contemplated by this section safe and adequate means of ingress and egress shall be provided for persons employed in and about the same.

All structures whose height exceeds twice their least dimensions at their base shall be so designed as to safely resist a wind pressure of 30 pounds per square foot of surface exposed to the action of the wind.

593. Skylights—Construction of—Glass in.) (a) Any skylight on the roof of any building less than ninety feet in height, other than a frame building, shall have the sides, sashes and frames constructed of metal, or of wood, metal clad on all exterior surfaces. Any skylight on a building more than ninety feet in height shall be entirely of incombustible material.

(b) Every skylight shall be provided with ventilation opening of an area of at least three per cent of the base area of the skylight.

(c) The glass in all such skylights, except in buildings in Classes III and VI, not exceeding three stories in height, shall have at least six inches over same a strong wire netting with wire not lighter than number twelve gauge, galvanized after weaving, and mesh not coarser than one by one inch, unless the glass contains a wire netting within itself. Supports for screen shall not be less in size than the bars supported and of the same material.

594. Enclosures Upon Roofs.) It shall be permitted to erect on the roofs of all buildings more than fifty feet and less than ninety feet high, skylights, inclosures for water tanks and inclosures for elevator machinery, the construction of all of which inclosures shall be entirely of incombustible material; provided, however, that the roofs of same may be built of mill or slow-burning construction.

595. Roof—Construction of—Pitch of.) Buildings, other than frame buildings when permitted by this Chapter, less than fifty feet in height with roofs which have a slope of more than three inches per horizontal foot, shall have the roofs covered with incombustible material. Buildings

more than fifty feet and less than ninety feet in height with roofs which have a slope greater than three inches per horizontal foot and which are of timber construction, shall have such roofs covered with an incombustible covering upon the roof boards, which shall be made either of mortar or porous terra cotta or plaster boards or other incombustible material, which shall be at least two inches thick. Where this covering is placed upon the roof boards wooden strips shall be inserted, which shall be securely fastened to the wooden structure at regular intervals between the incombustible coverings and a weatherproof covering of incombustible material.

596. Roofs—Shingle or Gravel.) (a) The use of shingles or other forms of combustible roof covering erected or altered, otherwise than provided in Section 601, within the fire limits, is prohibited, except as hereinafter provided. In existing frame buildings not more than three stories high, the shingle roofs may be repaired with shingles or other materials.

(b) Roofs, the slope of which is not more than three inches per foot horizontal, and the covering of which is made of a composition of felt and gravel, shall be considered incombustible under the provisions of this Chapter, and may be used upon buildings of all classes. Other forms of composition roof shall be permitted if expressly approved as an incombustible roof by the Commissioner of Buildings.

597. Window and Door Sills—Columns and Lintels Supporting Store Fronts—incombustible.) (a) For buildings other than frame buildings window and door sills shall be made of incombustible material. Oak timber used for door sills and not less than eight inches thick by the full width of the wall in which such sills occur, shall, for the purpose of this Chapter, be counted incombustible.

(b) In buildings other than frame and excepting buildings of Classes III and VI, lintels shall be of incombustible material, provided that in one-story store front buildings columns and lintels may be of combustible material.

598. Buildings—Height of.) (a) The limits of heights of buildings heretofore given for non-fireproof buildings shall be from the average established sidewalk level to the highest point of the roof thereof.

(b) The height of fireproof buildings shall be measured from the average grade of the street frontage of the building to the top of the highest point of the external bearing walls.

(c) No buildings shall be erected of greater height than two hundred feet from the sidewalk level to the highest point of external bearing walls; provided, however, that buildings may be erected of a height of two hundred sixty feet from the sidewalk level to the highest point of external bearing walls up to and until the first day of September, 1911, where a permit has been secured therefor and the work incident to the erection of said building has been begun before September 1, 1911. The erection of parapet walls or of balustrades constructed of any of incombustible material shall be permitted above the roof level of buildings of all classes, in addition to the height allowed herein for the same.

(d) Roof noises for elevators, tanks, skylights, stairs or scuttles may be built above the height of the main roof.

599. Basement and Cellar Defined.) A basement shall be defined as a story the floor of which is more than two feet below the average finished street grade or whose ceiling is less than nine feet above said grade at the front of the building; but this

definition of a basement shall not apply to buildings of Classes VI and VIII.

NOTE: See Section 132.

600. Sub-basements and Cellars—Construction of.) (a) No building shall have more than one basement or cellar of ordinary or slow-burning or mill construction; all additional basements or cellars shall be of fireproof construction as described in this Chapter, the elevator enclosures shall be of brick from the lowest basement floor level to the first story floor, and the stairways shall be inclosed in fireproof partitions from the lowest basement floor level to the first story floor level with automatic closing standard iron doors, opening outwards.

(b) In cases where a pipe, conduit, dumb-waiter, cable, wire, conveyor or belt, or any combination thereof, passes through a floor from one basement to another, the opening in the floor shall be inclosed as specified in this Chapter.

(c) The number and width of stairs from the lowest basement floor to the first story shall be the same as required for the four highest stories of a building of the same area.

601. Canopy—Plans Must be Approved by Commissioner of Buildings Before Permit Issued by Department of Public Works—Permit Cannot be Issued if Matter or Obstruction Permitted.) It shall be unlawful for any person, firm or corporation to erect or construct any canopy attached to a building or structure under any general or special ordinance now in force or which shall or may hereafter be adopted by the City Council of the City of Chicago, without first submitting the plans of such canopy, and also of the part of the building or other structure to which it is to be attached, to the Commissioner of Buildings for his approval. No permit shall be issued by the Department of Public Works unless the plans of such canopy shall be approved by the Department of Buildings and a permit to attach said canopy to the building for which it is intended shall be obtained from the Commissioner of Buildings. The owner or agent shall pay to the Department of Buildings a fee of \$5.00 for said permit. No canopy that has been or may hereafter be authorized by any general or special ordinance, which projects over any street or other public place shall at any time be enclosed by canopies or other cloth or material in whole or in part so as to obstruct free passage underneath same, nor shall any such canopy be equipped with or have attached thereto any illuminated or other signs, transparencies, placards, streamers or other advertising devices of any kind; and in case any such canopy shall at any time contain such advertising matter or device it shall be the duty of the owner, lessee, or person in charge or control of such canopy, upon notice from the Mayor, to forthwith remove such advertising matter or device.

Amended April 28, 1913.

602. Courts and Light Shafts in Buildings.) (a) Every court or light shaft of every building shall be open and unobstructed from the bottom of such court to the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

(b) All windows, doors or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors, with the glazed portions thereof of wired glass.

603. Bay Windows—Light Courts—Shafts—Construction of.) (a) The walls of every bay window and every court in every masonry constructed building, except buildings of Class III, shall be built of brick or other fireproof construction throughout as required for exterior walls.

(b) The walls of every vent shaft of every masonry constructed building, except buildings of Class III, shall be built of masonry or a fireproof material not less than four inches in thickness supported by steel or iron.

(c) Every court, light shaft, or vent shaft in every building shall be open and unobstructed from the bottom of such court to the sky with the exception that fire escapes may be built in courts or light shafts, subject to all the provisions of this Chapter.

(d) All windows, doors, or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors with the glazed portion thereof of wired glass.

604. Windows, Cleaning of—Safety Devices.) The owner or agent of every building in the city shall equip each and every window in any such building above the first story thereof with a suitable device or devices which will permit the cleaning of the exterior of each and every window in such building above the first story without danger to the person cleaning such windows, and such devices shall be of such pattern and construction as will reasonably and safely answer the purposes for which they are intended; provided, however, that if windows are of such construction that they may be easily cleaned from the inside they need not be equipped with such devices.

***605. (a) Wood Lathing and Plastering.)** In all buildings of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with these specifications:

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least two coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

(b) In every building of ordinary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms not used for habitation or living purposes), throughout the building shall be covered with not less than two coats of plaster of the thickness and quality heretofore in this section prescribed.

Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in the room used for the purpose of Class I; and provided further, that where such building of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisions:

The ceiling of the room or rooms used for the purpose of Class I shall first be plastered with at least one coat of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction

of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joint in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal-plates are applied on walls of buildings of ordinary construction containing one or more rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this ordinance for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every studding with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

*Amended March 5, 1914.

606. Scaffolds—Protection During Building Operations—Temporary Floors.) (a) All scaffolds erected in this city for use in the erection, repair, alteration, or removal of buildings, shall be well and safely supported, and of sufficient width, and properly secured, so as to insure the safety of persons working thereon or passing under or by the same; and to prevent the falling thereof, or of any material that may be used, placed or deposited thereon.

(b) It shall be the duty of every owner, person or corporation who shall have the supervision or control of the construction of or remodeling of any building having more than three framed floors, whether some or all of such floors are above the established street grade, to provide and lay upon the upper side of the joists or girders, or both, of the first floor below the riveters and structural steel setters, a plank floor, which shall be laid to form a good and substantial temporary floor for the protection of the employees and all persons engaged above or below or on such temporary floor in such building.

(c) Provided, however, that where the permanent floor is in place on the floor herein required to be planked, a temporary protective floor shall not be required.

(d) A good and substantial temporary floor shall be laid on the joists or girders of the next lower floor where the temporary or permanent floor of the second story or the floor or floors above the second story or roof is being placed previous to the placing of the permanent floor or floors immediately below the floor which is being arched or planked. The lowest framed floor in a building shall be considered the first floor.

(e) In buildings more than three stories high where persons are working on a scaffold or scaffolds on the outside of such building such persons shall be protected by well secured planking, set over the heads of such persons for the full width of the scaffolding on which they are working if another story or other stories are being raised above such persons during the time they are working on such outside scaffold or scaffolding.

(f) It shall be the duty of all owners, contractors, builders or persons having the control or supervision of all buildings in course of erection which shall be more than thirty feet high, to see that all stairways, elevator openings, flues and all other openings in the floors shall be covered or properly protected, and it shall be their further duty to comply with an act of the State Legislature providing for the protection and safety of persons in or about the construction, repairing, alteration or removal of buildings, bridges, viaducts and other structures, approved June 3, 1907, and in force July 1, 1907.

(g) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than one hundred dollars nor more than two hundred dollars for each offense, and any permit granted for the construction of such building may be

revoked in the discretion of the Commissioner of Buildings where such violation occurs.

607. Sidewalk and Street—Occupation of—Limitations.) (a) The extent of occupation of sidewalk and street to be covered by the terms of a permit for street obstruction or building, shall be as follows:

(b) Such permit shall not authorize the occupation of any sidewalk or street or part thereof other than that immediately in front of the lot or lots upon which any building is in process of erection and in relation to which such permit is issued.

(c) During the progress of building operations, a sidewalk not less than six feet in width shall be at all times kept open and unobstructed for the purpose of passage in front of such lot or lots. Such sidewalk shall, if there are excavations on either side of the same, be protected by substantial railings which shall be built and maintained thereon so long as excavations continue to exist. It is not intended hereby to prohibit the maintenance of a driveway for the delivery of material across such sidewalk from the curb line to the building site.

608. Sidewalks—Delivery of Material—Elevated Sidewalks.) It shall be permitted for the purposes of delivering material to the basements of buildings in process of erection to erect elevated temporary sidewalks to a height of not exceeding four feet above the curb level of the street, and in case a sidewalk is so elevated it shall be provided with good, substantial steps or easy inclines on both ends of the same and shall have railings on both sides thereof.

609. Temporary Roof Over Sidewalk—Time Maintained.) When buildings are erected of a height greater than four stories and such buildings are near the street line, there shall be built over the adjoining sidewalk a roof having a framework composed of supports and stringers of three by twelve timbers not more than four feet from center to center, covered by two layers of two-inch plank. When additional stories are added to an existing building and such building is located near the street line, there shall be built over the sidewalk, at the point where the new stories commence, a scaffold not less than six feet wide, which shall form a covering over the sidewalk composed of a framework of stringers and supports, covered by two layers of two-inch planks. Such framework and covering shall be of such construction and design as shall be satisfactory to the Commissioner of Buildings. Such roof shall be maintained as long as material is being used or handled on such street front above the level of the sidewalk. Temporary sidewalks, their railings, approaches and roofs over same, shall be made with regard to ease of approach, strength, and safety, to the satisfaction of the Commissioner of Buildings.

610. Storage of Building Materials—Limitations.) The occupation of the street for the storage of building material for any one building or for temporary sidewalks, shall never exceed one-third of the width of the roadway of the same, and in no event shall any material be stored or placed within four feet of any steam or street railway track, and in all cases where such obstruction of the street is made there shall be a clear space of not less than one foot between such obstruction and the curb line. Provided, that the Commissioner of Buildings and the Commissioner of Public Works, or either of them, may limit, or entirely restrict, the storage of material on any street or alley where a tunnel, conduit, or any underground passageway or subway is located.

611. Sidewalks and Street—Excavated Material and Rubbish On—How Cared for.)

Earth, other than sand to be used in the construction of the building, taken from excavations, and rubbish taken from buildings shall not be stored either upon the sidewalks or roadways of streets, and shall be removed therefrom from day to day as rapidly as produced. When dry rubbish is being handled, it shall be kept wetted down so as to prevent its being blown about by the wind.

612. Use of Derricks.) For all buildings more than four stories in height the use of derricks set upon the sidewalk or street is prohibited. In no case shall the guy lines be less than fifteen feet above the roadbed.

613. Frontage Adjacent—How Occupied for Building Purposes.) If the written consent of and a waiver of claims for damages against the city by the owners of properties adjoining the site of any proposed building is first obtained and filed with the Commissioner of Public Works, the permission to occupy the roadway and the sidewalk may be extended beyond the limits of such building in front of the property for which the consent of the owner or lessee thereof has been secured upon the same terms and conditions as those herein fixed for the occupation of sidewalk and street in front of the building site.

614. Street—Use of for Building Purposes—When Terminated—Red Lights.) (a) The permission to occupy streets and sidewalks for the purposes of building is intended only for use in connection with the actual erection, repair, alteration or removal of buildings, and shall terminate with the completion of such operation. It shall be unlawful to occupy any sidewalk or street after the completion of the operation for which a permit has been issued by the Department of Buildings. It shall also be unlawful to occupy a sidewalk or street, under authority of such permit, for the storage of articles not intended for immediate use in connection with the operations for which such permit has been issued.

(b) Red lanterns shall be displayed and maintained during the whole of every night at each end of every pile of material in any street or alley and at each end of every excavation.

615. Street Obstructions—Permits—Bonds—Fees.) (a) Permits for the obstruction of streets shall be issued by the Commissioner of Public Works and shall be paid in proportion to the street frontage occupied at the rate of two dollars per month for every twenty-five (25) feet, or fractional part thereof, of frontage so occupied, and before any permit shall be granted to any person, firm or corporation for the obstruction of any street or streets or sidewalk, an estimate of the cost of restoring said street and sidewalk to a condition equally as good as before it shall have been obstructed, with a fair additional margin for contingent damages, shall be made by the Commissioner of Public Works, which in no case shall be less than one dollar per foot, or fractional part thereof, frontage of the portion of the street to be obstructed, and a deposit shall be required of the person, firm or corporation desiring to obstruct said street or sidewalk. Such deposit, less the charge of two dollars per month for each twenty-five feet of frontage used, shall be returned upon the restoration of the said street and sidewalk to a condition equally as good as before it was obstructed. When the Commissioner of Public Works shall receive satisfactory proof that said street and sidewalk have been restored to a condition equally as good as before it was obstructed, he shall issue a certificate to the Comptroller, certifying to said fact, and the comptroller shall thereupon forthwith issue a warrant on the City Treasurer for the

amount of money thus deposited less the deduction herein provided for. But if the person, firm or corporation thus obstructing said street or sidewalk shall fail to restore the same to a condition equally as good as before it was obstructed within three (3) days from and after the completion of the building or structure for which said deposit was required, then the city shall have the right to use such portion of said deposit as may be necessary to remove the obstructions and to restore the said street and sidewalk to a condition equally as good as it was before it was obstructed, and the amount thus expended shall be deducted from the amount of said deposit; provided, however, that nothing herein contained shall preclude the city from maintaining an action against the person, firm or corporation to recover for damage done to any street or sidewalk. No permit shall be issued until the applicant therefor shall have executed and filed with the Commissioner of Public Works a bond, with sureties to be approved by said Commissioner, and in an amount to be designated by him, in no case to be less than ten thousand dollars, conditioned to indemnify, save and keep harmless the city from any and all loss, cost, expense or liability of any kind whatsoever which it, the city, may suffer or be put to, or which may be recovered from it from or by reason of the issuance of such permit, or by reason of any act or thing done or neglected to be done under or by virtue of the authority given in such permit and the requirements of the city ordinances.

(b) Any permit issued pursuant to the terms of this ordinance may be revoked by the Commissioner of Public Works at any time.

*616. **Stables and Barns—Regulations.)** (a) It shall be unlawful for any person, firm or corporation to convert any building for the use of or to construct or maintain any stable or barn for the housing or keeping of more than two horses or other animals on any lot abutting on a street or alley in which a public sewer is constructed without providing such stable or barn with an impervious floor properly drained to such sewer.

(b) It shall be unlawful for any person, firm or corporation to construct, locate, conduct or maintain any boarding, sales or private stable or barn for stabling or keeping of horses on the front two-thirds of any lot exclusively for residence purposes without the written consent of a majority of the property owners according to frontage on both sides of the streets. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building or place for such purpose. Provided that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street and located upon a corner lot shall not be considered.

*(c) It shall hereafter be unlawful for any person, firm or corporation to locate, build, construct or maintain any building or structure for stabling or keeping of ten or more horses within a distance of two hundred feet from any school, church, hospital, public park or public playground.

(d) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than twenty-five dollars (\$25.00) nor more than two hundred dollars (\$200.00) for each offense; and each and every day on which such person shall conduct or maintain a stable or barn in violation of the provisions of this section, shall constitute a separate and distinct offense.

Paragraph (a) amended November 18, 1912, and December 14, 1914.

*Paragraphs (b) and (d) amended November 18, 1912.

*Paragraph (c) amended June 22, 1914.

617. **Tannery Not to Be Placed Within 600 Feet of Any Church, Public or Private School.)** It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any building used, or to be used, for a tannery within six hundred feet measured from the nearest point of the tannery to the nearest point of any building used for a church or for a public or private school.

617½. **Gas Reservoir Not to Be Placed Within 500 Feet of any Public School.)** It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any tank used or to be used for a gas reservoir within 500 feet of any public school. Said distance to be measured from the nearest point of the building or structure used for a gas reservoir to the nearest point of any building used for a public school.

618. **Architect—Must Certify That Plans Comply With Building Ordinances.)** It shall be unlawful for any architect or other person permitted under the state law to prepare plans to prepare and submit to the Commissioner of Buildings for his approval any final plans for any building or structure which do not comply with structural requirements of this Chapter. It shall be the duty of the Commissioner of Buildings to require that all final plans submitted to him for approval of any building or structure shall be accompanied by a certificate of such architect or such other person preparing plans that the plans and specifications submitted comply with the structural requirements of this Chapter.

ARTICLE XIII.

Fireproof Construction.

*619. **Fireproof Construction—Definition of.)** The term "fireproof construction" shall apply to all buildings in which all parts that carry weights or resist strains and also all exterior walls and all interior walls and all interior partitions and all stairways and all elevator inclosures are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by coverings of a material which shall be entirely incombustible, and a slow heat conductor, and hereinafter termed "fireproof material." Reinforced concrete as defined in this ordinance shall be considered fireproof construction, when built as required by Section 504.

*Amended February 20, 1911.

620. **Fireproof Material—Definition of.)** The materials which shall be considered as filling the conditions of fireproof covering are: First, burnt brick; second, tiles of burnt clay; third, approved cement concrete; fourth, terra cotta.

621. **Fireproof Construction—Tests For.)** (a) In cases in which it is claimed that any equally good or more desirable mode or manner of construction, or material, or device for fireproofing, other than specified in this Chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings, upon written application to him for a permit to use the same, shall have power to appoint a Board of Examiners, consisting of not less than three nor more than five members, each of whom shall have at least ten years' experience as an architect, engineer or builder, who shall take the usual oath of office. Said oath of office shall be administered by the Commissioner of Buildings. The said examiners shall adopt rules and specifications for examining and testing such mode or manner of construction or material, or device for fireproofing, and furnish a copy of the same to the applicant. And such specifications shall provide that the material to be tested shall withstand successfully a fire of two hours' duration, rising to 1,700 degrees tempera-

ture, Fahrenheit, in the first thirty minutes and remaining at that temperature for the following ninety minutes. At the end of the two hours the material shall be quenched with at least a 1½-inch stream of water for five minutes, at a nozzle pressure of fifty pounds per square inch. The said examiners shall notify such applicant to submit the proposed material for such examination and test; and such tests shall be made in the presence of the said examiners, or a majority thereof, according to such rules and specifications. All expenses of such examiners and such examinations and tests, shall be paid by the applicant, and said examiners may require security therefor.

(b) The said examiners shall within 30 days after such examination and tests, certify the results of such test, and their decision on the said application to the Commissioner of Buildings, who shall in the event of the examination and tests being satisfactory, authorize the use of such material or construction as fireproof material.

(c) A complete record of the proceedings and all acts and decisions of the said Board of Examiners shall be kept by the Commissioner of Buildings in his office.

(d) The Commissioner of Buildings shall have the power to pass upon any question relative to the mode or manner of construction or materials to be used for fireproofing in the erection or alteration of any building or structure to make the same conform to the true intent and meaning of the several provisions of this Chapter.

***622. Incombustible Material.)** *The following materials shall be considered as incombustible material: A metal or fire-resisting glass not less than one-quarter of an inch in thickness, metal, plastering on metal lath and metal-scaffolding, plaster blocks, stone, granite, marble, approved Cinder concrete, or one of the fireproof materials described in this chapter.*

**Amended February 20, 1911.*

623. Walls—Enclosing in Buildings of Steel Skeleton Construction.) If buildings are made of fireproof construction, and have skeleton construction so designed that their enclosing walls do not carry the weight of floors or roof, then their walls shall not be less than twelve inches in thickness; provided, such walls shall be thoroughly anchored to the iron skeleton, and whenever the weight of such walls rests upon beams or columns, such beams or columns shall be made strong enough in each story to carry the weight of wall resting upon them without reliance upon the walls below them. All walls shall be of fireproof or incombustible material.

624. Columns—Exterior.) (a) All iron or steel used as vertical supporting member of the external construction of any building exceeding fifty feet in height shall be protected against the effects of external change of temperature, and of fire by a covering of fireproof material consisting of at least four inches of brick, hollow terra cotta concrete, burnt clay tiles, or of a combination of any two of these materials, provided that their combined thickness is not less than four inches. The distance of the extreme projection of the metal, where such metal projects beyond the face of the column, shall be not less than two inches from the face of the fireproofing; provided, that the inner side of exterior columns shall be fireproofed as hereafter required for interior columns.

(b) Where stone or other incombustible material not of the type defined in this ordinance as fireproof material is used for the exterior facing of a building, the distance between the back of the facing and extreme projection of the metal of the column proper shall be at least two inches,

and the intervening space shall be filled with one of the fireproof materials.

(c) In all cases, the brick, burnt clay, tile or terra cotta, if used as a fireproof covering, shall be bedded in cement mortar close up to the iron or steel members, and all joints shall be made full and solid.

625. Columns—Interior.) (a) Covering of interior columns shall consist of one or more of the fireproof materials herein described.

(b) If such covering is of brick it shall be not less than four inches thick; if of concrete, not less than three inches thick; if of burnt clay tile, such covering shall be in two consecutive layers, each not less than two inches thick, each having one air space of not less than one-half inch, and in no such burnt clay tile shall the burnt clay be less than five-eighths of an inch thick; or if of porous clay solid tiles, it shall consist of at least two consecutive layers, each not less than two inches thick; or if constituted of a combination of any two of these materials, one-half of the total thickness required for each of the materials shall be applied, provided that if concrete is used for such layer it shall not be less than two inches thick.

(c) In the case of columns having an "I" shaped cross section or of columns having any other cross section with channels or chases open from base plates to cap plates on one or more sides of the columns, then the thickness of the fireproof covering may be reduced to two and one-half inches, measuring in the direction in which the flange or flanges project, and provided that the thin edge in the projecting flange or arms of the cross sections does not exceed three-quarters of an inch in thickness. The thickness of the fireproof covering on all surfaces measuring more than three-quarters of an inch wide and measuring in a direction perpendicular to such surfaces shall be not less than that specified for interior columns in the beginning of this section, and all spaces, including channels or chases between the fireproof covering and the metal of the columns, shall be filled solid with fireproof material. Lattice or other open columns shall be completely filled with approved cement concrete.

626. Columns—Wiring Clay Tile On.) (a) Burnt clay tile column covering shall be secured by winding wire around the columns after the tile has all been set around such columns. The wire shall be securely wound around tile in such manner that every tile is crossed at least once by a wire. If iron or steel wire is used it shall be galvanized and no wire used shall be less than number twelve gauge.

(b) In places where there is trucking or wheeling, or handling of packages of any kind, the lower five feet of every column with hollow tile shall be incased in a protective covering of No. 16 U. S. gauge steel embedded in concrete.

***627. Concrete—Approved Cement—When Fireproof.)** (a) All approved cement concrete shall consist of a standard Portland cement, torpedo sand, and crushed stone or gravel, or crushed blast furnace slag, or crushed burnt clay, the volumetric quantity of any one of these materials in addition to the torpedo sand shall not exceed eight times the volume of the Portland cement. All of the ingredients of cement concrete shall be thoroughly worked and wet so as to cover each piece of stone or gravel or slag or burnt clay with moistened cement; and the cement and sand shall fill the voids between the coarse material of the cement concrete.

(b) *Cement concrete to be considered a fireproof material shall comply with the provisions*

of Section 563 and shall be cast and worked in an unset condition against the metal. In all cases where cinder concrete is used, the metal shall be protected as required by Section 568 of this Chapter.

*Amended February 20, 1911.

628. Concrete Ingredients.) (a) The separate ingredients of concrete shall be measured for each batch, and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing. The concrete shall be worked continuously with suitable tools, as it is put in place, filling the forms completely.

(b) The sand to be used for concrete shall be clean coarse sand, free from loam or dirt. If crushed stone grit is used it shall be clean, gritty, and free from dust.

(c) The stone to be used in concrete shall be clean crushed hard stone, or clean crushed blast furnace slag, or gravel, and of a size to pass through a 1½-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using.

(d) In all cases, the brick or hollow tile, solid or terra cotta shall be bedded in cement mortar close up to the iron or steel member and all joints shall be made full and solid.

629. Pipes Enclosed by Covering.) (a) Pipes shall not be enclosed in the fireproofing of columns or in the fireproofing of other structural members of any fireproof building; provided, however, gas or electric light conduits not exceeding one inch diameter may be inserted in the outer three-fourths inch of the fireproofing of such structural member, where such fireproofing is entirely composed of concrete.

(b) Pipes or conduits may rest upon the tops of the steel floor beams or girders, provided they are imbedded in cinder concrete to which slaked lime equal to five per cent of the volume of concrete has been added before mixing or their being imbedded in stone concrete.

630. Shafts—Doors—Frames—Enclosure.)

(a) In cases where a pipe, conduit, dumb waiter, cable wire, conveyor, belt, or any combination thereof, passes from one story to another story through an open hatch or floor opening, a shaft or enclosure of fireproof material shall be built from floor to floor around such hatch or floor opening in each story above and below such hatch or floor opening in the same manner as described for fireproof partitions in this chapter, and no wood shall be used in the construction, support or fittings of such shaft. The area of space thus enclosed shall not exceed the area of the floor opening by more than one hundred per centum.

(b) All burnt clay or terra cotta partitions or walls around such shafts shall be plastered on the outside and plastered or pointed on the inside.

(c) All doors, frames, sashes, casings and windows in partitions or walls around such floor openings, shall be built of incombustible material. The supports of such doors, frames, sashes, casings and windows shall also be of incombustible material. In the case of doors, such supports shall be of rolled structural metal extending from floor to ceiling and secured to both. Where there are brick walls of twelve inches or more in thickness, the supports need not extend to ceiling as above specified. All glass used in connection with such partitions or walls shall be wired glass.

(d) Such fireproof enclosures may be omitted if all of the space in each floor opening not occupied by pipes, conduits, cables, wires, or any combination thereof, are filled in solid fireproof material not less than eight inches thick.

631. Spandrel Beams, Girders, Lintel.)

The metal of the exterior side of the spandrel beams or spandrel girders of exterior walls, or lintels of exterior walls, which support a part of exterior walls, shall be covered in the same manner, and with the same material as specified for the exterior columns in this chapter; provided, however, that shelf angles connected to girders by brackets or projections of girder flanges not figured as part of the flange section, may come within two inches of the face of the brick or other covering of such spandrel beams, girders or lintels. The covering thickness shall be measured from the extreme projection of the metal in every case.

632. Beams, Girders and Trusses—Coverings of.)

(a) The metal beams, girders and trusses of the interior structural parts of a building shall be covered by one of the fireproof materials hereinbefore specified so applied as to be supported entirely by the beam or girder protected, and shall be held in place by the support of the flanges of such beams or girders and by the cement mortar used in setting.

(b) If the covering is of brick, it shall be not less than four inches thick; if of hollow tiles or if of solid porous tiles, or if of terra cotta, such tiles shall be not less than two inches thick, applied to the metal in a bed of cement mortar; hollow tiles shall be constructed in such a manner that there shall be one air space of at least three-fourths of an inch by the width of the metal surface to be covered within such clay coverings the minimum thickness of concrete on the bottom and sides of metal shall be two inches.

(c) The top of all beams, girders, and trusses, shall be protected with not less than two inches of concrete or one inch of burnt clay bedded solid on the metal in cement mortar.

(d) In all cases of beams, girders or trusses, in roofs or floors, the protection of the bottom flanges of the beams and girders and so much of the web of the same as is not covered by the arches shall be made as hereinbefore specified for the covering of beams and girders. In every case the thickness of the covering shall be measured from the extreme projection of the metal, and the entire space or spaces between the covering and the metal shall be filled solid with one of the fireproof materials, excepting the air spaces in hollow tile.

(e) Provided, however, that all girders or trusses when supporting loads from more than one story shall be fireproofed with two thicknesses of fireproof material or a combination of two fireproof materials as required for exterior columns in Section 625 of this chapter, and each covering of fireproof material shall be bedded solid in cement mortar.

633. Fireproofing of Exterior Sides of Mullions.)

In buildings required by this chapter to be of fireproof construction on exposures where metal frames, doors, sash and wired glass are not required, all vertical door or window mullions over eight inches wide shall be faced with incombustible material, and horizontal transom bars over six inches wide shall be faced with a fireproof or with an incombustible material.

634. Fireproof Covering, Independent.)

The fireproof covering of brick, concrete, burnt clay tiles, hollow terra cotta or of a combination of any two of these materials shall be applied to all of the structural members of the exterior of a fireproof building previous to and independent of the application of the architectural facing of such fireproof building with an incombustible or fireproof material.

635. Walls, Support and Fireproofing of.)

Where skeleton construction is used for the whole or part of a building the enveloping material and the walls shall be

independently supported on the skeleton frame for each individual story.

636. Iron or Steel Plates for Support of Wall.) Where iron or steel plates or angles are used in each story for the support of the facings of the walls of such story, such plates or angles shall be of sufficient strength to carry the weight within the limits of fibre stress for iron and steel elsewhere specified in this chapter of the enveloping material for such story, and such plates or angles may extend to within two inches of the exterior of such covering.

637. Cut-out Boxes, Chases, Etc.—Fireproof Covering.) No electric service cut-out box, switch box, cabinet, chase or any other recess, shall encroach on the minimum thickness required for any fireproof covering on structural metal, except as provided in this chapter. If the depth of any cut-out box, switch box, cabinet, or chase, or if any other recess is to be concealed, or partially concealed, then the thickness of the fireproof covering shall be increased correspondingly.

638. Segmental and Flat Arches.) (a) Segmental arches shall have a rise of at least one inch for each foot of span of arch.

(b) The least thickness of a hollow tile or porous terra cotta segmental arch shall be one-half of an inch per foot of span, but no such hollow tile or terra cotta arch shall be of a thickness less than five inches.

(c) Both flat and segmental arches shall be so constructed that the joints of the same radiate from a common center and there shall be a cross rib for every four inches, or fractional part thereof, in height in each tile block. The skewback of the arches shall be carefully fitted to the beams supporting them, and, in addition to the cross ribs, there shall be additional diagonal re-enforcing ribs in the skewback. Such arches, whether flat or curved, shall have their beds well filled with cement mortar, and the centers shall not be struck until the mortar has set.

(d) Burnt clay skewbacks shall be molded in such a manner as to support the burnt clay covering on the under sides of beams or girders.

639. Fireproof Floor and Roof Construction.) Brick, hollow tile, porous terra cotta, or approved cement concrete, or approved cinder concrete, shall be used for the construction of floor and roofs of fireproof buildings. Flat arch hollow tile, or flat arch porous clay tile floor arches shall have a height of at least one and one-half inches for each foot of span.

640. Wood Flooring and Nailing Strips.) (a) Wood flooring and wooden nailing strips for such flooring may be used in fireproof buildings.

(b) Where such flooring is used in a fireproof building, the space immediately under the flooring, and between the nailing strips and under such nailing strips, shall be filled with a cement or a cinder concrete tamped into place in an unset state, or with such other incombustible material as shall be approved by the Commissioner of Buildings.

641. Partitions in Fireproof Buildings.) (a) Where stairs, shafts and elevators are enclosed they shall be enclosed in fireproof partitions, as described in Section 642 of this chapter; all other partitions, shall be incombustible partitions. Where blocks are used for building partitions or as enclosing walls, the joints shall be well filled with mortar.

(b) The partitions shall be wedged tight between floor and ceilings with incombustible wedges.

642. Partitions — Fireproof — Incombustible.) (a) Only fireproof material shall be used for fireproof partitions; if of brick, they

shall be not less than four inches thick, and if of partition blocks, not less than three inches thick. If fireproof partitions are of reinforced concrete they shall be not less than three inches thick.

(b) All fireproof partitions required by this ordinance shall be supported directly on the steel construction, or on the fireproof floor arches, or on concrete, or on brick.

(c) Only fireproof or incombustible material shall be used in the construction of partitions not required to be fireproof, excepting that frames, casings, doors, sash and the rough carpenter work required for the proper fastenings of such frames, casings, doors or sash, may be of wood, and that ordinary glass may be used in doors and partition windows.

(d) All corridor partitions of incombustible or fireproof material in fireproof buildings, shall be supported directly on the steel construction, on the fireproof floor arches, on concrete or on brick.

643. Stairs—Landings.) (a) Stairs in fireproof buildings shall be built of approved cement concrete, reinforced concrete, stone or metal, or a combination of one or more of such materials.

(b) The handrails of such stairways may be of wood.

(c) If stairs are constructed of solid stone or plain concrete, having the tread and riser in one piece, then there shall be not less than sixty square inches of stone or concrete in the cross section of such combined tread and riser.

(d) If stone treads have less than sixty inches of cross section and platforms less than seven inches in thickness are used, they shall have a metal sub-tread and sub-platform three thirty-seconds of an inch thick.

(e) If platforms have a floor arch sub-construction as described in Sections 638 and 639 of this chapter, then the metal sub-platform may be omitted.

644. Roofs—Rise of Roof Above Limit of Height.) In the case of buildings which are fireproof in their construction, the roof may rise above the limit of height of wall fixed by this chapter for such buildings at a slope not to exceed thirty degrees with the horizon, and to a height not exceeding twenty feet above such limitation of the height of the wall. The space enclosed by such roof above the limitation of the height of such wall may be used as an inclosure for pipes, ventilating or elevator machinery or for ventilating ducts, but it shall not be lawful to use such space for purposes of storage, business or residence.

645. Sheet Metal Work—Support Of.) Wood shall not be used as the support of any sheet metal work or of any gutter or cornice of a building more than ninety feet in height.

ARTICLE XIV.

Slow Burning Construction.

***646. Slow-Burning Construction Defined.)** The term "Slow-Burning Construction" shall apply to all buildings in which the structural members, other than walls elsewhere required to be of masonry, which carry the loads and strains which come upon the floor and roofs thereof are made wholly or in part of combustible material, but throughout which the structural metallic members, if used, are fireproofed as required for fireproof construction. Where metallic lintels are used to cover wall openings the fireproofing on the underside may be omitted where such lintels are fireproofed on the other three sides and all voids in them are filled solid with fireproof material. The lower five feet of metal columns shall be protected as required in Section 634 of this

Chapter. Underside of joists shall be protected by a covering of three coats of plaster laid on metal lath; and a layer of mortar or other incombustible material at least one and one-half inches thick shall be applied on all floors and roof surfaces above the joists of same.

*Amended May 17, 1915.

***647. Posts, Girders and Partitions.)**

Wood posts, if used, shall be of not less than one hundred square inches sectional area. Wood girders, if used, shall be of not less than seventy-two square inches sectional area. All partitions in buildings of this type shall be made entirely of incombustible material. Wood furring, wood studs and wood lath shall not be permitted in buildings of this type.

*Amended February 20, 1911.

648. Stairs, Construction of.) Where buildings are required to be of "slow burning" construction, all stairs in such building shall be of incombustible material, except as hereinafter provided. Said stairs may be of ordinary construction, if said building is equipped with an automatic sprinkler system, and stairs are enclosed in a fireproof wall.

ARTICLE XV.

Mill Construction.

***649. Definition—Mill Construction Requirements.)** The term "Mill Construction" shall apply to all buildings in which wooden posts, if used, have a sectional area of not less than one hundred square inches, and wooden girders and joists a sectional area of not less than seventy-two square inches, and roofs, if of wood, a thickness of not less than two and five-eighths inches in a single layer, and floors, if of wood, a thickness of not less than three and one-half inches in not more than two layers, the lower one of which shall be not less than two and five-eighths inches in thickness, and in which all structural metallic members, if used, are fireproofed as required for fireproof construction. Where metallic lintels are used to cover wall openings the fireproofing on the underside may be omitted where such lintels are fireproofed on the other three sides and all voids in them are filled solid with fireproof material. All floors and roofs not constructed as above shall be of fireproof construction as elsewhere required for fireproof construction in this ordinance.

*Amended May 17, 1915.

***650. Fireproofing.)** (a) Partitions in buildings of mill construction shall be made entirely of incombustible material. If iron columns, girders, or beams are used in buildings of this type they shall be protected as specified in this Chapter; but the wooden posts, girders and joists need not be protected by fireproof covering. Wood furring, wood studs and wood lath shall not be permitted in buildings of this type.

*Amended February 20, 1911.

(b) If reinforced cinder concrete construction is used in the structural parts of a building which is required to be of slow-burning or mill construction by this chapter, then all partitions shall be of incombustible material and all parts other than structural parts and partitions of the building shall be as required for slow-burning or mill construction buildings by this chapter.

651. Stair Construction Where Automatic Sprinkler System is Installed.) In buildings required to be of "mill construction," all stairs in such buildings shall be of "incombustible" material, except as hereinafter provided. Said stairs may be of wood construction if said building is equipped with an automatic sprinkler system and stairs are enclosed in a fireproof wall.

ARTICLE XVI.

Ordinary Construction.

652. Ordinary Construction Defined.) The term "ordinary construction" as used in this

chapter, means the ordinary system of construction in which timber and iron structural parts are not protected with fire-resisting coverings and in which the walls are of masonry built as required by this chapter.

ARTICLE XVII.

Frame Buildings.

653. Repairing of Frame Buildings Within Fire Limits.) Frame buildings within the fire limits which have been damaged by fire, decay or otherwise, to an extent not greater than fifty per cent of their value may be repaired, provided there is no increase in size of such buildings over their original dimensions, and, provided that incombustible roof covering required by Section 596 is used. And, provided, further, that where any frame building is raised for the purpose of erecting a basement story under the same, the walls enclosing such basement shall be of masonry.

***654. Frame Buildings Prohibited—Exceptions.)** (a) Hereafter no frame building shall be erected, nor any frame addition made to any existing frame building, within the fire limits of the city, except where express provision is made in this chapter therefor.

(b) Outside the fire limits it shall be lawful to erect frame buildings not exceeding forty feet in height from the sidewalk to the highest point of roof. If such frame buildings have a basement story of masonry, their height above the sidewalk may be made not to exceed forty-five feet. Provided, however, that in no case shall any portion of any frame building above the second floor be used as a separate living apartment.

(c) It shall be lawful to surround frame buildings with a veneer of brick not less than four inches in thickness, provided the said brick is not carried higher than the second story, or twenty-two feet above the basement ceiling; and provided further that the said veneer is anchored to the studding or other frame construction in a manner satisfactory to the Commissioner of Buildings. Such brick veneer is not to be placed on gables or any other parts of frame buildings above the height herein specified. All frame buildings which it is desired to surround with brick veneer must have their basement walls and foundations of solid masonry, as provided in Section 658 of The Chicago Code of 1911.

*Paragraph (c) added March 19, 1912.

655. Frame Buildings Within the Fire Limits Changed Into Flat Buildings—Fire Walls.) Whenever any frame building within the fire limits shall be remodeled, altered or changed for the purpose of using the same for flats or apartments, or whenever such frame building shall be occupied for flat or apartment purposes, each suite of apartments in such building shall be separated from every other suite of apartments in such building by a wall of incombustible material, of such dimensions and thickness as required by this chapter.

656. Frame Buildings—Raising—Requirements—Changing Gable or Hip Roofs to Flat Roofs.) Permission may be granted by the Commissioner of Buildings for the raising of existing frame buildings, whether within or without the fire limits, to the limits of height hereinbefore fixed for new frame buildings, and no more, and inside the fire limits for the purpose of putting a masonry basement thereunder. The Commissioner of Buildings is also authorized to issue permits for changing gable or hip roofs of existing frame buildings to flat roofs, and for the raising of walls incident to such change. But if such hip or gable roof is changed to a flat roof and the walls raised in connection with such change, the total cubic contents

included by the walls so raised and the roofs so altered shall not exceed the cubic contents originally included in such gable or hip roof, and in no case shall a two-story and attic building be converted into a three-story building thereby.

657. Frame Buildings Carried to a Uniform Height.) Where the different parts of a frame building inside the fire limits are of different heights a one-story portion may be raised to the height of two stories, provided the greatest height thereof does not exceed the limits of height prescribed in this chapter for frame buildings and provided, that no room in the existing building or in the addition thereto shall violate the requirements of this chapter for habitable rooms.

***658. Basement or Story Placed Beneath Frame Buildings.)** A frame building may be raised for the purpose of erecting a basement or story, or both, thereunder, but the principal floor of such frame building shall not be raised to a higher level than 16 feet above the grade of the sidewalk upon which such premises abut. *Where a building so raised one story in height only and the same is raised so as to permit a basement under the same as to exceed six feet six inches in height from the basement floor to the ceiling of said basement, the soil house may be placed upon cellar posts. In all other cases the walls enclosing such basement or story shall be of masonry and not less than 12 inches thick except where a one-story frame building is raised and has a basement only built thereunder, the masonry walls of such basement may be eight inches thick above grade and 12 inches thick below. The foundation of such wall shall be constructed as provided in this chapter; provided, however, that no frame building shall be raised for the purpose of constructing a basement or story, or both, under the same to a greater height to the top of its roof than that elsewhere herein given as the maximum height above grade for frame buildings. The thickness of walls hereinbefore required shall also apply to brick walls in new frame buildings.*

**Amended July 8, 1912.*

***659. Chimneys in Frame Buildings—Chimney Flues Through Partitions.)** *(a) Chimneys in frame buildings shall be built as required in Section 584 of this Chapter. The roof framing of frame buildings shall be framed around chimneys in such a manner as not to come within two inches of the same.*

(b) Metal smoke pipes or tile flues shall not extend through the floors or through the ceiling or roof of any building; and where such smoke pipes or tile flues pass through partitions the woodwork of such partitions shall be protected by a sheet metal ventilated tin thimble at least twelve inches greater in diameter than the diameter of the flue.

**Amended February 20, 1911.*

660. Lot Lines—Requirements as to—Number—Dimensions.) Frame buildings, excepting sheds not exceeding three hundred square feet in area shall not be built nearer than one foot to any line of the lot upon which they are built, street and alley lines excepted, except as hereinafter provided. It shall not be lawful to erect a frame building wider than forty feet nor deeper than seventy feet, unless such building be divided by a fire wall or fire walls, built of incombustible material and of a thickness of not less than four inches and of construction to be approved by the Commissioner of Buildings, so that no more than two thousand eight hundred square feet of superficial area shall be contained in any section or part of such building, uninclosed by such fire walls, and if openings are set out in such fire walls, then such walls

shall be built of brick not less than eight inches thick, and such openings shall have doors as described in Section 573. Each section of such buildings shall be regarded as a separate building for the purpose of determining the number and construction of its stairways and means of egress. If more than one frame building is built in the direction of the depth of any one lot, such buildings shall not be built with a less distance than ten feet between them except where both buildings are used for living purposes, and in that case the distance shall be governed by Sections 439 and 440 of this chapter.

***661. Sheds—Open Shelter—Height of Walls and Foundations—Enclosed.)** (a) Except as hereinafter provided, open shelter sheds not exceeding eight hundred square feet in area not exceeding fourteen feet in height from the ground may be erected within the fire limits, provided they have roofing of incombustible material and the highest point is not over fifteen feet above the ground, and provided that the roofs be supported on sufficient posts or piers; provided, however, that such sheds may be built with an area not to exceed sixteen hundred square feet, if they are kept at least twenty-five feet from any lot line and any other building or structure. Such sheds shall have no combustible enclosing walls or wooden floors, except that a floor of two-inch planking laid directly upon the ground may be used. Such sheds shall only be erected upon the rear of the lot, and not more than one such shelter shed or any other shed shall be erected on any lot of twenty-five feet in width.

(b) If it is desired to enclose an open shelter shed, the enclosing walls shall be made of brick, hollow tile, or other incombustible material, and such walls shall have foundations extending to solid ground and at least four feet below the surface of the ground.

(c) Open shelter sheds may be erected outside the fire limits not to exceed twenty-eight hundred square feet in area and subject to the approval of the Commissioner of Buildings; provided, however, that shelter sheds which comply in other respects with the requirements of this section, may be built not to exceed nine thousand square feet in area where such sheds are located at least twenty feet distant from any other structure and from any lot line.

(d) *Sheds not exceeding fourteen feet in height from the ground to the highest point thereof, and not exceeding three hundred square feet in area, with an incombustible roof, may be constructed of wood within the fire limits. Such sheds shall not be located on the front part of any lot, nor shall they be used as a dwelling or as an addition to a dwelling house, or for any business purpose whatever, nor shall more than one shed be erected on any one building lot of twenty-five feet in width.*

**Paragraph (d) added February 20, 1911.*

662. Sheds—Coal, Brick, Stone, Cement and Salt Sheds and Sheds for Icing Cars Along Railroad Tracks and Navigable Streams.) Open shelter sheds to be used for the storage or handling of coal, brick, stone, cement, salt or such commodities which are incombustible, or for the icing of cars, may be erected within or without the fire limits upon, along or adjacent to steam railroad tracks, or along or adjacent to navigable waters; provided, such sheds shall have incombustible roofing and shall not exceed 35 feet in height from the ground to the highest point of the roof; provided, further, that said sheds shall be located at least 25 feet distant from any other structure and from any side lot line. If it is desired or intended to enclose any such sheds, the enclosing walls shall be of incombustible material. No such shed shall

be built upon any lot or parcel of ground fronting upon any street within 75 feet of any building used exclusively for residence purposes, unless the consent of the owners of the majority of the frontage on both sides of such street between the two nearest intersecting cross streets shall first have been obtained by the person, firm or corporation desiring to erect and maintain such shed, and said written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for such shed.

***663 Ice Houses.)** (a) Houses within the fire limits to be used exclusively for the storage of ice, not exceeding forty-five feet in height, and of a floor area not exceeding 9,000 square feet, may be constructed of wood with incombustible roofing, the walls to be enclosed with an envelope of incombustible material; eight-inch walls of brick or tile or approved cement concrete with proper foundations of masonry shall be used for such envelopes.

*Amended February 20, 1911.

(b) Houses to be used exclusively for the storage of ice, located outside of the fire limits and contiguous to any lake and six hundred feet from any other building, except buildings used in connection with the conduct of said business, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed eighty thousand square feet, unless the building is divided by a solid wall of masonry for each additional 80,000 square feet of floor area, or fractional part thereof; and shall extend at each end not less than one foot beyond the enclosure of said building and such wall shall be subject to the approval of the Commissioner of Buildings.

(c) Houses to be used exclusively for the storage of ice, located outside of the fire limits, and contiguous to railroad tracks and not within one hundred feet of any other building, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed 20,000 square feet unless the building is divided by a solid wall of masonry for each additional 20,000 square feet of floor area or fractional part thereof; said wall shall extend at least one foot beyond the enclosure of said building on each end and shall be approved by the Department of Buildings.

(d) All dividing walls must extend through and above the roof of any building in which they are built to a distance of three feet and must be covered with incombustible coping. No dividing wall shall be of less thickness than twelve inches at any point thereof.

***664. Lumber Yards—Not to be Located Near Residence Except by Consent.)** No person or corporation shall establish, maintain, conduct or operate within the fire limits of the city as the same are now or may hereafter be defined by ordinance, any lumber yard or place where new or second hand lumber is kept for sale or is stored for seasoning or drying on any premises fronting on any street in any block where two-thirds of the buildings on any street surrounding any such block are used exclusively for residence purposes, unless the written consent of the owners of a majority of the frontage on both sides of all the streets surrounding the block in which it is proposed to locate, establish, conduct or maintain such lumber yard or place, be first obtained by the person or corporation desiring to establish, maintain or operate such lumber yard or place, consenting to the issuance of a permit from the Department of Buildings, and also consenting that a license for the establishment, keeping or maintenance of such lumber yard or place shall be issued by the city. Such written consent shall accompany the application for a license

and building permit made by such person or corporation.

*Amended May 6, 1912.

***665. Storage of Lumber Near Planing Mill or Private Residence, Tenement House or Hotel.)** No lumber shall be piled within the fire limits of the city as the same are now or may hereafter be defined by ordinance, for the purpose of storing, seasoning or drying the same, within fifty feet of any planing mill or woodworking manufactory, nor within one hundred feet of any private residence, tenement house or hotel, unless the same has been erected since the establishment of such yard.

*Amended February 24, 1913.

(Note: Section 665 repeated March 30, 1914, and Section 303 of Fire Prevention and Public Safety Ordinance, passed in lieu, which is at end of this ordinance.)

ARTICLE XVIII.

Stairways.

666. Stairways, Number—Location—Construction.) (a) Fireproof office buildings existing at the time of the passage of this ordinance which are equipped either with one stairway and two or more stairway fire escapes or with two stairways and one or more stairway fire escapes, shall not be required to have additional stairways or stairway fire escapes.

(b) Except as otherwise expressly provided in this Article, it shall be unlawful to construct or maintain any building or structure of Classes I, II and VII unless its stairway or stairways comply with the following provisions:

(c) In every existing building of ordinary construction having an area greater than 9,000 square feet or of mill or slow-burning construction greater than 12,000 square feet, there shall be not less than three stairways. The width of stairs shall be at least eighty per cent of the width of stairs as computed by the formulae given herein and in no case less than twelve feet.

(d) Every building shall have at least one stairway from the ground to the top floor and one stairway from the lowest basement or cellar to the street grade, and no stairway shall be less than three feet in width.

(e) The width of stairs required for a building shall be constructed as the total width of all stairways required on the building. Stairs shall be measured between the wall and handrail for a single stair and between handrails where two or more handrails are required by this chapter.

(f) In buildings of Class I and Class IIa the width of stairs and fire escapes required for a building shall be determined by the floor area measured on the third floor of the building and such area shall not include walls, columns, stairs, elevator shafts, well holes, chimneys and corridors. In all cases where the building is less than three stories in height the width of stairs shall be determined by the floor area of the second floor as hereinafter specified.

***667 Stairs—Number and Width of in Classes I, II and VII.)** (a) In buildings of Class IIb, Class IIc and Class VII the number and width of the stairs and fire escapes shall be determined by the area of that portion of the third floor not occupied by walls, columns, stairs, elevator shafts and well-holes.

In buildings of Class I, II and VII the number and width of stairs required shall be as follows:

(b) IN ORDINARY CONSTRUCTION.

With floor area of 5,000 square feet or less, two stairways;

With floor area of 5,000 to 9,000 square feet, three stairways.

*Provided, however, that in buildings of ordinary construction, existing prior to December 5, 1911, with floor area of 5,000 square feet or less, one stairway may still be required where the building is not equipped with an outside stairway fire escape, and in all such buildings with floor area of from 5,000 to 9,000 square feet, two stairways only shall be required; provided such building is also equipped with an outside stairway fire escape.

*Amended July 22, 1912.

(c) The width of stairs required in buildings of ordinary construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by twelve and dividing the product by 1,000 and adding 72 inches to the quotient, expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3,000) \text{ times } 12}{1,000}$$

(d) IN MILL OR SLOW-BURNING CONSTRUCTION.

With floor area of 6,000 square feet or less, two stairways.

With floor area of 6,000 to 12,000 square feet, three stairways.

(e) The width of stairs required in buildings of mill or slow-burning construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in feet and multiplying the remainder by eight and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3,000) \text{ times } 8}{1,000}$$

(f) IN FIREPROOF CONSTRUCTION.

With floor area of 7,000 square feet or less, two stairways.

With floor area of 7,000 to 15,000 square feet, three stairways.

With floor area of 15,000 to 21,000 square feet, four stairways.

With floor area of 21,000 square feet and over, five stairways.

(g) Provided, however, that in fireproof buildings having an area of 21,000 square feet or more only four stairways shall be required if such building is completely equipped with an approved automatic sprinkler system.

(h) The width of stairs required in buildings of fire-proof construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in feet and multiplying the remainder by six and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3,000) \text{ times } 6}{1,000}$$

(i) Provided, however, that where buildings of Class I are of fireproof construction and are used solely for storage warehouse purposes and the number of persons employed on any one floor does not exceed the number specified hereafter in this section they shall comply as to number of stairways as follows:

With floor area less than 8,000 square feet where not more than ten persons are employed on a floor, two stairways.

With floor area greater than 8,000 square feet and less than 15,000 square feet where not more than fifteen persons are employed on a floor, three stairways.

With floor area greater than 15,000 square feet where not more than twenty persons are employed on a floor, four stairways.

(j) The width of stairs shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in feet and multiplying the remainder by four and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3,000) \text{ times } 4}{1,000}$$

*668. Stairs—Other Requirements.) (a)

The width of stairway fire escapes and three-quarters of the width of sliding fire escapes required by this chapter may be deducted from the width of stairs required.

(b) Stairways shall be located as far from each other as practicable. The bottom of each stairway shall be in the immediate vicinity of the top of the stairs leading to the next lower story and the line of travel from stairway to stairway shall be direct and easily accessible each to the other. At least one stairway shall extend to the roof of every building. In Classes I, II and VII, the whole number of stairways required for each building shall be complete in every respect from the first to the topmost story.

(c) Every story below the street grade shall have not less than two stairways to the first story and each such stairway shall be not less than three feet wide, but where a basement or cellar is used for the retail sale of goods the stairway from such basement or cellar shall in number and aggregate width comply with the requirement of this section for the first four stories above sidewalk grade.

(d) Where two areas of the same building adjoin and are separated by fireproof dividing walls they may have a stairway in common, provided such stairway is not less than five feet wide and is inclosed in all stories of the building by fireproof walls in non-fireproof buildings and by fireproof partitions in fireproof buildings; and where the stairways and landings are built as required by this chapter for buildings of fireproof construction, and where the doors, frames, sashes and casings, and the glazed portion thereof are built as described in Sections 572 and 573 then in such case such stairway may be considered as equivalent to one open stairway from each such area, and where such stairway provides exit from only one floor area such stairway may be considered as equivalent to two open stairways but in no case shall there be less than two stairways in any such building except as otherwise provided in this chapter.

(e) Where adjoining buildings or buildings on opposite sides of an alley or other open space, and of the same class, used by the same person, firm or corporation, are connected by fireproof bridges or passageways with fireproof doors at each end, or by fireproof doors on each floor built and equipped as required by this chapter for dividing wall doors if such bridge or passageway or fireproof door is located as far as practicable from the stairways in both said buildings, then said bridge or passageway or fireproof door may be considered to be equivalent to a stairway for each of the two areas.

(f) In buildings of classes I, II and VII, where an interior stairway is enclosed in a tower and built as required by the provisions of Section 669 paragraph (n) of this Chapter, then such stairway shall be considered the equivalent of two stairways, or a stairway and a fire-escape; provided, however, that if such stairway is considered the equivalent of two stairways the building must be

equipped with a stair-way fire-escape, or fire-escapes, as is required by this Chapter.

*Amended December 4, 1911.

(g) Exterior stairways in buildings of Class I, II and VII built entirely of steel and iron, having ice-proof treads not less than ten inches wide from nosing to riser and a riser of eight inches or less for each riser, and otherwise made as required for stairway fire escapes in this chapter and where such stairway fire escape extends from the inside grade to the top floor of the building or is supplied from the second floor to the ground with a counterbalanced section and has a steel ladder from the top landing to the roof, then such stairway may be considered the equivalent of one interior stairway and one stairway fire escape if the width of such stairway and that of the one or more stairways in the building equals the width of stairs required by this chapter; provided, that in such case the respective floors, door sills, and stairway platforms are flush, and that the doors do not obstruct the stairs or platforms and that the doors are each at least 90 per cent of the width of said stairway and that the windows, doors and frames passed by such stairway and platforms are built of incombustible material and wired glass.

(h) In buildings of Class I not more than three stories in height, a stairway fire escape not less than three feet wide located and built as required by this chapter for such fire escape and placed as far as practicable from the stairway, may be considered as a stairway and may be deducted from the "width of stairs" required for the building.

(i) The width of different stairways need not be alike, and for each four stories or fractional number of stories of the building above the first four stories each stairway may be reduced six inches, but no stair in a Class VII building shall be less than three feet in width.

(j) Stairways which are less than three feet three inches wide shall have not less than one hand rail and stairways which are more than three feet three inches wide shall have not less than two handrails. Stairways which are over eight feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high.

(k) Stairways hereafter erected shall not be spiral stairways or have any winders. Provided, however, that circular or elliptical stairways may be used if the width of treads one foot from the center of the handrail next to the well-hole is nine and one-half inches, including nosings.

(l) Stairways shall not have risers more than eight inches high nor treads less than ten inches wide, inclusive of nosings.

(m) The bottom of any counter-balance stairway or ladder fire escape hereafter erected on any public thoroughfare when raised shall be not less than fourteen feet above the pavement or surface of the street or alley.

(n) The location of every stairway required by this article shall be subject to the approval of the Commissioner of Buildings.

ARTICLE XIX.

Fire Escapes.

*669. **Fire Escapes—Number and Location.** (a) It shall be unlawful for any person, firm or corporation to construct or maintain any building of Classes I, II, III, VI, and VII within the city, unless the same shall be equipped with fire escapes as follows:

(b) Every building four or more stories in height, except such as is used exclusively

for a residence for one family shall have one or more incombustible sliding or stairway fire escapes, as required by this chapter, except as otherwise herein provided.

(c) There shall be at least one stairway fire escape constructed as required by the provisions of this chapter for each 250 persons, or fractional part thereof, who occupy any floor of any building habitually and daily or for whom working, sleeping or living accommodations are provided on any one floor above the third floor of any building or structure.

(d) BUILDINGS OF ORDINARY CONSTRUCTION SHALL BE EQUIPPED WITH FIRE ESCAPES AS FOLLOWS:

With floor area of 6,500 square feet or less, one 24-inch stairway fire escape.

With floor area of 6,500 square feet to 9,000 square feet, two 24-inch stairway fire escapes.

(e) BUILDINGS OF MILL OR SLOW-BURNING CONSTRUCTION SHALL BE EQUIPPED WITH FIRE ESCAPES AS FOLLOWS:

With floor area of 8,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 8,000 square feet to 12,000 square feet, two 24-inch stairway fire escapes.

(f) BUILDINGS OF FIREPROOF CONSTRUCTION SHALL BE EQUIPPED WITH FIRE ESCAPES AS FOLLOWS:

With floor area of 10,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 10,000 to 20,000 square feet, two 24-inch stairway fire escapes.

With floor area of more than 20,000 square feet, three 24-inch stairway fire escapes.

(g) FIREPROOF WAREHOUSE BUILDINGS SHALL BE EQUIPPED WITH FIRE ESCAPES AS FOLLOWS:

With floor area of 12,000 square feet or less, one 24-inch stairway fire escape.

With floor area exceeding 12,000 square feet, two 24-inch stairway fire escapes.

(h) A fireproof bridge built as described in Section 668 and connecting each floor of two neighboring buildings occupied by the same person, firm or corporation, shall be considered the equivalent of a fire escape, or of an interior stairway, but not the equivalent of both.

(i) In buildings of Class II there shall be a stairway or a fire escape as near as practicable to the end of each corridor, and where a corridor is endless the stairs and the fire escapes shall be located around and connected to said hall or corridor at distances approximately equal to each other.

(j) The openings leading to fire escapes on hospitals shall be flush with the floor leading to the fire escape which may be inclined not more than 2½ inches vertical to 12 inches of horizontal measurement, and shall be constructed and maintained with no obstructions thereon.

(k) In buildings hereafter erected whenever stairway fire escapes are considered the equivalent of an interior stairway or as taking the place of any of the "Width of Stairs" required by this chapter, there shall be a door or casement window leading to such fire escape from each floor. Windows and doors to such fire escapes shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such windows or doors shall not be more than 24 inches above the floor, unless a stair is built leading to the same.

(l) Where a building is divided into separate areas, each such area shall be considered as a separate building and shall be equipped with stairs and fire escapes as is required for buildings by this chapter, unless otherwise herein provided.

(m) Exterior stairway fire escapes built as required by this chapter and having treads not less than 10 inches wide from

nosing to riser and risers not more than 8 inches in height and having stairways extending from the inside grade to the top floor of the building or having a counter-balance section from the first story to the ground and a steel ladder from the top landing to the roof, shall be considered the equivalent of one interior stairway and one stairway fire escape. If the width of such stairway fire escapes with that of one or more stairways in the building equals the "Width of Stairs" required for the area of the respective buildings by this chapter.

n. Where a Fire Shield Stairway is constructed according to the following provisions and requirements, such Fire Shield Stairway shall be considered the equivalent of a stairway or stairways in a fire escape and stairway or stairways combined, as per the provisions of Paragraph "f" of this section.

The Fire Shield Stairway shall be divided or separated from the building by, and completely enclosed with, brick walls or walls of fireproof material not less than twelve inches thick, or by a wall of reinforced concrete and tile in combination not less than ten inches thick subject to the approval of the Commissioner of Buildings. The walls of said Fire Shield Stairway are to be built from the lowest floor level to and at least thirty-six inches above the roof, except as otherwise herein provided. The roof of said Fire Shield Stairway shall be built of fireproof construction. The stairs of said Fire Shield Stairway shall be of fireproof construction, and all door openings must be provided with fireproof thresholds, metal frames and approved incombustible doors. The risers of the stairs shall be not more than eight inches and the tread not less than nine inches, and winders in stairs shall not be permitted. The nearest riser of the stair in a downward direction must be remote from the entrance to the Fire Shield Stairway a distance not less than the width of the stairs. The entrance to the Fire Shield Stairway shall be by a fireproof vestibule or by an outside balcony. Said balcony shall be constructed on private property and shall not encroach on or overhang a public street or alley. Said vestibule or balcony shall be not less than five feet wide and the floors, ceiling and sides thereof shall be of fireproof material. One side of said Fire Shield Stairway shall face a street or alley or an open space leading directly to and connecting with a public street or alley. The side of said vestibule facing the street, alley or other open space, shall be open for the full width thereof from a point ten feet above the floor to the underside of ceiling in each story.

The open space above said wall may be enclosed by a fire shield in the following manner only:

A metal frame constructed of steel of commercial shape, or a sheet metal frame filled with concrete, with a horizontal cross piece midway between the top and bottom of said frame, may be fitted in the opening flush with the inside face of the wall. This frame may be hung with two sashes, sash to be of metal and glazed with fire-resisting glass, hinged at the bottom and arranged to open out from the top, and restrained by angle iron or chain attached to the inner part of jambs of the opening, so as to allow sash to rest on sime in an open position in such a manner that the top edge of sash will be flush with the outer face of the wall. The masonry work at the head of the wall opening shall be beveled off at an angle of forty-five degrees. The opening and closing of these sashes must be controlled by a mechanical device to be approved by the Commissioner of Buildings.

Where sash exceed five feet in width, intermediate floors of masonry sixteen inches wide by the width of wall in thickness may be built, and the opening openings shall be enclosed as herein provided.

All sash and fire-resisting glass installed shall be subject to specifications and requirements to be contained in this ordinance.

Any entrance from the building into the Fire Shield Stairway shall be through the vestibule or balcony or balcony or balcony. All openings from the building into the lobby or vestibule and from the lobby or vestibule into the Fire Shield Stair-

way shall be not less than six feet nor more than seven feet in height and not less than four feet in width, and shall be provided with approved incombustible doors hung in metal frames and may be glazed with fire-resisting glass. In all cases, the floor of the vestibule or balcony, or floor landing of stairs, and the floor of the building containing Fire Shield Stairway shall be at the same level.

Where balconies are used as a means of access from the building to the Fire Shield Stairway, the floors of same shall be solid and built of fireproof material, and shall be of sufficient strength to sustain a load of one hundred pounds per square foot within the safe limits of stress for materials, as elsewhere specified in this chapter. Said balcony on each story shall be provided on the open side with an incombustible enclosure four feet high. There shall be a sufficient number of landings in the wall between the vestibule and stairway, or the doors to stairway shall be fitted with fire-resisting glass of sufficient area to properly light the said Fire Shield Stairway. All said window openings shall be equipped with metal frames and sash and fire-resisting glass. The entire stairway, vestibule and balconies on all floors shall be provided with adequate means of illumination by gas or electricity on a separate circuit, and shall be lighted during all the time any part of the building in which they are located is being used after sunset or whenever lighting shall be required. The Fire Shield Stairway shall terminate at a landing on a level with, or not to exceed six inches above the street, alley or other open space on which said Fire Shield Stairway faces; and access from said landing to said street, alley or other open space, shall be direct by means of an incombustible door or doors equipped with a metal frame and fire-resisting glass, not less than six feet nor more than seven feet in height, and not less than four feet in width. Connection to said Fire Shield Stairway from first floor will not be required if first floor has sufficient exits properly located. All doors to Fire Shield Stairway shall be of the style known as "double acting doors." In buildings other than skeleton construction a slip joint must be provided in the masonry walls between the tower and any wall connecting or abutting thereto, subject to the approval of the Commissioner of Buildings.

Plans in detail, showing the construction and equipment and all other features of a Fire Shield Stairway shall be submitted in addition to the general plan showing the proposed location of same. Such details shall be drawn to an enlarged scale, and shall consist of a typical floor plan, a typical elevation and cross section of one or more stories and other stories which deviate from typical plan, and shall be approved by the Commissioner of Buildings before a permit for construction of same is issued.

*Amended March 30, 1914.

(o) In buildings not more than two stories in height one stairway may be omitted if the building is equipped with a three-foot stairway fire escape built as required for fire escapes in this section with counter-balance drop and placed as far as practicable from the remaining stairway.

(p) Where fireproof buildings have a frontage upon public alleys or have courts of an area of not less than 320 square feet, and where such courts lead directly to a public thoroughfare, fire escapes may be permitted to be erected on such courts or such alleys and shall not be required to be erected upon the street fronts of such buildings. Such fire escapes shall be located as far as possible from stairways in the buildings, and where it is possible to erect the fire escapes on an alley or in a court they may be thus erected subject to the approval of the Commissioner of Buildings.

(q) In fireproof buildings of Class IIa, fire escapes may be located in light courts of fifty feet in the least dimension, having no opening onto a street or alley, but such fire escape must be connected with a stairway of the building at a level no higher than twenty-five feet above finished grade at the building, said stairway to terminate at the

first floor level in a public corridor, giving direct egress from the building.

(r) Such fire escapes shall not be considered as part of the width of stairs as defined in Section 666 of this chapter for such buildings unless that portion of the stairway used in connection with the fire escape is increased by the width of the fire escape, from their junction to the ground.

Hospitals two or more stories in height shall be provided with one or more stairway fire escapes not less than 40 inches between handrails. Sliding fire escapes shall have a radius or width of not less than 42 inches. Sliding fire escapes shall not be built on public thoroughfares and shall deposit the person from same not more than twenty-four inches from the surrounding ground, and sliding fire escapes on Class VIII buildings shall be constructed, located and maintained in accordance with the provisions relating to Class VIII.

Wherever stairway fire escapes are considered by this chapter to be the equivalent of an interior stairway or as taking the place of any of the width of stairs, there shall be a door leading to said fire escape from each floor. Such door shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such door shall not be more than 24 inches above the floor and the door shall be as wide as the stairway required on the fire escape. Where the sill is more than 24 inches from the floor, a small stairway shall be built from the floor to the window sill with treads not less than 10 inches wide and risers not more than 9 inches in height.

(s) A stairway fire escape placed on an exterior wall adjacent to a dividing or party wall shall be considered as a stairway fire escape for each building area to which it is adjacent. In such cases there shall be at least one door or window from each building area leading to the fire escape platform, and the width of each such fire escape shall not be less than 36 inches.

(t) All fire escapes shall be located and constructed to conform to the building for which they are respectively intended.

(u) If any building used wholly or in part for the purposes of Class VII be equipped with automatic sprinklers, and be connected with another building similarly used, and distant not less than twenty-five feet and used by the same occupant, by a fireproof bridge or passageway similarly equipped, then each such tier of bridges or passageways shall be held to be equivalent to and take the place of one outside stairway fire escape on each of the buildings so connected.

670. Stairway Fire Escapes—Fees—Erection of—Location—Painting—Component Parts.) (a) The Commissioner of Buildings and his assistants shall determine upon the location of all stairway fire escapes before erection of same is commenced.

(b) Before the work is commenced a permit shall be obtained from the Commissioner of Buildings for which a fee of \$2.00 shall be exacted.

(c) No permit for a stairway fire escape more than twenty-four inches in width shall be granted unless a detailed plan for the fire escape, approved by a licensed architect or a structural engineer, is submitted to the Commissioner of Buildings, and a copy of such plans shall be left on file with said Commissioner.

(d) All anchors for stairway fire escapes shall, wherever possible, pass through the wall of building and be secured on inside of same. Where it is possible to anchor through walls, anchors shall be put in wall not less than fifteen inches at an angle of

thirty-five degrees. On buildings of steel construction, where walls are less than twenty inches in thickness there shall be steel channels at least four inches wide set on inside of building from column to column and bolted or riveted to columns, and anchors shall be bolted on inside of channels.

(e) Anchors for a platform four feet two inches or less in width shall be made of one inch square iron; over four feet two inches and not over six feet, shall be one and one-fourth inch square iron with brace; over six feet shall be one and one-half inch square iron with brace. All anchors shall be turned up not less than eight inches at the outside of the platform on which to bolt the post.

(f) Braces shall be the same thickness as the anchors. The spread of the braces shall be the width of the platform. Where the platforms are over five feet in width, anchors shall have double braces, one to the outside and one to the center of the platform.

(g) Platforms shall be not less than fifty inches wide at ends; passageways shall be not less than twenty-four inches between buildings and railings. Platforms shall be not less than five feet in length. The frames and crossbars shall be made as provided in this chapter. Platforms shall have clips at each end bolted to anchors. No door or window or shutter shall open so as to obstruct in any way the free passage on or along a platform or a stairway fire escape.

(h) All stairway fire escapes for apartment buildings, hotels, boarding houses, factories and office buildings, where there are less than 100 people on any one floor, shall be not less than two feet wide between hand rails. Stringers for a 24-inch stairway fire escape shall be not less than 2 inches by $\frac{3}{8}$ inch set $1\frac{1}{2}$ inches apart. Where stairway fire escapes and their balconies and supports are designed and constructed in accordance with the provisions of this chapter relating to materials permitted for such stairway fire escapes, balconies and supports, so as to sustain a load of 100 pounds per square foot, they may be built of steel channels, angles, or I-beams, but when so constructed, they shall comply with the provisions of this chapter in all other respects. All stairway fire escapes for halls, churches, theaters, hospitals, schools, department stores and buildings where large numbers of people congregate shall not be less than three feet wide in the clear, and all passageways shall not be less than three feet wide in the clear. Stringers for a 36-inch stairway fire escape shall be made of two bars, 3 inches by $\frac{5}{8}$ inch, about one inch apart, or $4\frac{1}{2}$ inches by $\frac{3}{8}$ inch flat iron, or of steel channels, angles or I-beams; where over 12 feet in length, they shall have an anchor and brace in the center. The tread shall be made of one-half inch square steel or iron, corner upwards, not to exceed $1\frac{5}{8}$ inches center, riveted at ends to 2 by $\frac{5}{8}$ inch flat iron or steel. There shall be not less than four bars to a tread where treads are less than twenty-seven inches in length; where treads are over twenty-seven inches in length there shall be not less than six bars to a tread; there shall be a truss supporting treads made of bar iron 2 inches by $\frac{3}{8}$ of an inch in thickness, riveted to bars of treads in center, supported by not less than two inches by seven-sixteenths of an inch rods bolted at each end of treads. All stairs shall have an incline of about forty-five degrees. The rise shall be not more than nine inches and the tread not less than nine inches.

(i) All stairs shall have three bar railings made of one-inch bar iron for top rail.

and three-fourths inch bar iron for lower rail, and when such stairs are more than three inches from the wall of the building, there shall be one or more hand rails on the wall side of such stairs.

(j) All posts used for stair fire escapes shall be made of one and one-half inch angle or channel iron not less than three feet six inches high measured at right angles with the treads of such fire escapes, and shall have braces on the outside turned upwards and fastened to the frame of the balcony or stairs, which shall be not less than half way up the posts; all stair fire escapes shall extend to the ground, either by counterbalance drop or stairs. All ladder fire escapes shall have either extension ladder or counterbalance drop from the first story of said building to the ground or sidewalk. Their location, material and construction shall be subject to the approval of the Commissioner of Buildings. Where cables are used for counterbalance stairs they shall not be less than three-quarters of an inch in size and shall be well oiled or greased when hung up and shall be oiled or greased at least twice a year. All pulleys and cables holding counterbalance drop shall be covered at bracket so as to be protected from snow or ice.

(k) Whenever a stairway fire escape passes a window or door on buildings hereafter erected, the windows or doors shall be of wired glass and shall have metal frames and sash, and whenever such a fire escape passes above a window, door or other opening not fitted with wired glass and metal frames the said fire escape shall be protected on the under side by sheet metal of not less than No. 26 United States gauge opposite such opening and for a distance of three feet on each side thereof. The use of intermediate platforms shall be permitted on all buildings now built or hereafter constructed whenever it is possible by their use to avoid the necessity of stairway fire escapes passing windows. All fire escapes shall be painted with two coats of mineral paint when erected, one at the shop and one upon completion at the building, and they shall be painted at least once every year thereafter.

(l) Whenever it is impossible to erect stairway fire escapes according to the provisions of this chapter, plans shall be submitted to the Commissioner of Buildings showing the location, material and construction of such stairway fire escapes as are proposed to be built before a permit is issued for the same, and if it is found to be impracticable to locate and construct fire escapes in accordance with the provisions of this chapter and that fire escapes built according to the plan presented would afford safe and practical means of exit from the building on which they are to be placed, then the Commissioner of Buildings may in his discretion approve the same. All such fire escapes shall be inspected by the Commissioner of Buildings on their completion and if found to be safe, satisfactory and in compliance with said approved plans, a certificate shall be issued to such effect upon the payment of \$2.00 to the City Collector. All fire escapes other than such as it is impossible or impracticable to build in accordance with the provisions of this chapter shall be inspected by the Commissioner of Buildings on their completion, and if found to be in compliance with the provisions of this chapter a certificate shall be issued by the Commissioner of Buildings upon the payment of a fee of \$2.00 to the City Collector.

(m) It shall be unlawful for any person, firm or corporation to use any building until the provisions of this article shall have been complied with.

671. Ladder Fire Escapes—When Permitted.) Where a building of Class III or VI, not more than four stories in height has two flights of stairs leading from the ground to the top floor of the building and where also each occupant shall have access to at least two separate and distinct stairways located as required by the provision of this chapter from the top floor to the ground, a ladder fire escape may be used in lieu of the stairway fire escape required herein, where a counter balance drop is placed from the ladder fire escape to the ground.

***672. Specifications for Ladder Fire Escapes.)** (a) All single and double ladder fire escapes hereafter erected shall be in strict accordance with the following provisions:

(b) There shall be not less than three one-inch square wrought iron anchors to every five-foot balcony and not less than six for a twelve-foot balcony. Such anchors shall pass through the wall of the building and be bolted on the inside with a three-fourths by two-inch nut and three and one-half inch iron washer back of the nut, where the wall is not over twenty inches thick; but where the wall is over twenty inches thick anchors shall be inserted at least eight inches into the wall at an angle of thirty-five degrees.

(c) Where a ladder fire escape is permitted by this chapter, the side guards shall be two by three-eighths inch flat iron. All ladder fire escapes shall be seventeen inches or more in width in the clear. No . . . pipe nor rusted or defective material shall be used in the construction of ladder fire escapes. Rungs of ladders shall be of not less than one-half-inch square iron with corners upward, so as to give a safe footing. Rungs shall be riveted and shall be constructed with fourteen-inch centers.

*Amended February 20, 1911.

(d) The brace for the anchors shall be at least twenty inches spread and shall extend into the wall four inches; no other form of anchor shall be allowed except by special permit from the Commissioner of Buildings.

673. Balconies—Construction of.) All balconies hereafter erected shall be either steel or wrought iron and capable of sustaining a weight of one hundred pounds to the square foot. The balcony frame shall be made of not less than two-inch by two-inch by one-fourth inch angle iron which shall be securely riveted together with crossbars every two feet. Such bars shall be punched one-half inch square close to the top of the bar on two inch centers and one-half inch square iron bars shall be forced through the same. The crossbars shall be securely riveted to the angle iron frame. The crossbars for a balcony twenty-eight inches wide shall be two inch by three-eighths inch. Balcony frames over twenty-eight inches wide shall be made of not less than two by three-eighths inch iron and made to conform with the increased dimensions of iron in crossbars; for thirty-six inch balcony or more they shall be two and one-half inch by three-eighths inch. All balconies over this width shall have a two-inch "T" iron through the center of the balcony for the bars to rest upon; provided that such balconies and platforms of buildings of Class IIC may be built as described in Section 268 of this chapter. Such balconies shall have a substantial cast or wrought iron post every three feet bolted to the balcony. No balcony shall have less than three guard rails which shall be of wrought iron or new iron pipe not less than three-fourths inch in diameter and the ends shall be securely anchored to the wall of the building and shall be not less than ten inches on an angle of thirty-five degrees. Where stairway fire es-

capas and their balconies are designed and constructed in accordance with the provisions of this chapter to sustain a load of one hundred pounds per square foot, they may be built of steel channel angles or I-beams, but in such cases they shall comply with the requirements of this chapter in all other respects.

674. Standpipes—Pumps—Axes, Etc., and Fire Fighting Apparatus.) (a) In every building one hundred feet or more in height not provided with a three-inch or larger inside standpipe and in all buildings hereafter constructed of a greater height than seventy-five feet excepting buildings used for the purposes of Class IIc and Class V as herein elsewhere provided for, and in all buildings of a greater height than five stories now or hereafter used for hotels or public lodging house purposes, there shall be installed one or more four-inch standpipes, which shall extend from the basement to the roof and which shall be connected at the outside of the street or alley side of the building with a Siamese connection provided with iron cap for use of the fire department, and which shall be provided with one hose connection, with fire department thread, on the roof of said building, on each floor and in the basement thereof, with sufficient hose attached to reach any point thereof. The pattern, quality, installation and maintenance of such standpipe, hose and couplings, shall be subject to the approval of the Fire Marshal.

(b) In any of the buildings herein referred to which are completely equipped with an approved automatic sprinkler system it shall not be necessary to install inside standpipes as above provided for.

675. Grain Elevators, Malt Houses and Cold Storage Houses—Steamer Connections—Sprinkler System.) The interior of all grain elevators and malt houses of a height of fifty or more feet which are not of fireproof construction, and which have a capacity of two hundred and fifty thousand bushels or over; and the interior of all cold storage houses of a height of four or more stories which are not of fireproof construction and which have a ground floor area of ten thousand or more square feet, shall be completely equipped with either a dry or wet approved automatic sprinkler system with a feeder or riser pipe or pipes not less than four inches in diameter, leading from one or more Siamese steamer connections provided with iron caps, all of which shall be installed and maintained subject to the approval of the Fire Marshal.

676. Grain Elevators, Malt Houses and Cold Storage Houses—Watch Service.) (a) Grain elevators which are equipped with an approved fire alarm system, properly maintained; or grain elevators, malt houses and cold storage houses which are now equipped with standpipes and hose of approved quality, and which have outside standpipes not less than 2½ inches in diameter, and Siamese steamer connections properly located; and which are equipped with fire extinguishers, water barrels and pails distributed at proper intervals on all floors; and where some approved electric watch service and fire alarm system is maintained, and a watchman is employed to pull such stations at least once an hour every day and night of the year, all of which shall be subject to the approval of the Fire Marshal, will not be required to install additional inside standpipes as provided in the foregoing sections.

(b) It shall be unlawful for any person, firm or corporation to erect, use or maintain any building as a grain elevator, malt house or cold storage house unless such building complies with all the provisions of this section, or unless the Fire Marshal has such

building examined and certifies to the Commissioner of Buildings that such building complies in all respects with the provisions of this section, and each day's unlawful use of such building, as above provided, shall be considered a separate offense.

677. Steamer Siamese Connections.) There shall be a Siamese connection at the bottom of each standpipe, so that two steam fire engines may be attached to it without interfering with each other. Such Siamese connection shall be within easy reaching distance from the sidewalk and be securely anchored to the wall of the building. The owner, agent, occupant or person in possession, charge or control of the premises where such standpipe and Siamese connection are located, is hereby required to provide such covering or protection as is provided for in Sections 674 and 675 to the fittings of said Siamese connection for the purpose of keeping said fittings and connection clear and unobstructed. The protection or covering herein referred to shall apply to all inside and outside standpipes and connections to automatic sprinkler equipment now in existence or hereafter installed.

678. Fire Escapes—Signs Indicating Location.) Every building required to be equipped with metallic ladder fire escapes and wrought iron or steel balconies, sliding or stairway fire escapes, or other fire escape devices, shall have displayed in conspicuous places, on each floor of such building, notices sufficient in number and in plainly legible type at least six inches in height, indicating and showing the location of such fire escapes and the easiest way to reach them. If such notices be not displayed within thirty days after such equipment is installed and kept continuously displayed the Commissioner of Buildings shall cause the building to be closed and kept closed until the provisions of this section shall have been complied with.

679. Stairs and Fire Escapes—Obstruction, Change in Construction.) It shall be unlawful under any circumstances to close up or obstruct any stairways or fire escapes of any buildings or the approaches leading thereto. No change in the position or construction of any such stairway or fire escape shall be made, unless the permission of the Commissioner of Buildings shall first have been obtained.

ARTICLE XX.

Ventilation.

680. Ventilation in Buildings of Classes IV, V, VII and VIII.) (a) The air in any room used as an auditorium in buildings of Class IV and V, hereafter erected and the air in any room used as a classroom or assembly hall in buildings of Class VIII, hereafter erected, shall be changed, so as to provide each person for whom seating accommodation is provided in such auditorium, classroom or assembly hall with at least 1,500 cubic feet of air per hour.

(b) In buildings of Class VII, hereafter erected, on floors frequented by the public the air in such rooms shall be supplied at the following rates:

For each person in basement, 2,000 cubic feet per hour.

For each person in 1st to 3rd stories, both inclusive, 1,500 cubic feet per hour.

For each person in 4th story and above, except as hereinafter provided, 1,300 cubic feet per hour.

For each person in grocery departments and restaurants, 1,500 cubic feet per hour.

(c) For the purpose of determining the number of people on any floor in buildings of Class VII, in calculating the means of

ventilation, the following floor area per person per floor shall be taken as the basis:

Basement, per person, 20 square feet of floor area exclusive of walls, stairs and elevators.

First story, per person, 20 square feet of floor area, exclusive of walls, stairs, elevators, and enclosed show windows.

Second story, per person, 50 square feet of floor area, exclusive of walls, stairs, elevators, and enclosed show windows.

Third story, per person, 60 square feet of floor area, exclusive of walls, stairs and elevators.

Fourth story and above, per person, 80 square feet of floor area, exclusive of walls, stairs and elevators, except as hereinafter provided.

(d) Grocery departments and restaurants, per person, 40 square feet of floor area, exclusive of walls, stairs and elevators.

(e) The amount of carbon dioxide in the air of any such auditorium, classroom or assembly hall or space frequented by the public in Class VII buildings shall not be permitted to rise above 10 parts of carbon dioxide per 10,000 parts of the air, measurements being taken at levels from two and one-half feet to eight feet above the floor, generally distributed, and the temperature in such spaces when artificially heated shall not exceed 68 degrees Fahrenheit. Relative humidity shall not be less than 45 degrees nor more than 80 degrees.

(f) The air in any room used as an auditorium in buildings of Classes IV and V, constructed prior to the passage of this ordinance, and the air in any room used as a classroom, or assembly hall in buildings of Class VIII, constructed prior to the passage of this ordinance, shall be changed, so as to provide each person for whom seating accommodation is provided in such auditorium, classroom or assembly hall with at least 1,200 cubic feet of air per hour.

(g) The air in any rooms and floors in buildings of Class VII, erected prior to the passage of this ordinance, shall be supplied, by mechanical or other means, at the following rates:

For each person in basement, 1,600 cubic feet per hour.

For each person in 1st to 3rd stories, both inclusive, 1,200 cubic feet per hour.

For each person in 4th story and above, except as hereinafter provided, 1,040 cubic feet per hour.

For each person in grocery departments and restaurants, 1,200 cubic feet per hour.

(h) For the purpose of determining the number of people on any floor in buildings of Class VII, in calculating the means of ventilation, the following floor area per person per floor shall be taken as the basis:

Basement, per person, 20 square feet of floor area exclusive of walls, stairs and elevators.

First story, per person, 20 square feet of floor area exclusive of walls, stairs, elevators and enclosed show windows.

Second story, per person, 50 square feet of floor area exclusive of walls, stairs, elevators and enclosed show windows.

Third story, per person, 60 square feet of floor area exclusive of walls, stairs and elevators.

Fourth story and above, per person, 80 square feet of floor area exclusive of walls, stairs and elevators, except as hereinafter provided.

Grocery departments and restaurants, per person, 40 square feet of floor area exclusive of walls, stairs and elevators.

(i) The amount of carbon dioxide in the air of any such auditorium, classroom or

assembly hall or space frequented by the public in Class VII buildings shall not be permitted to rise above 12 parts of carbon dioxide per 10,000 parts of air, measurements being taken at levels from two and one-half feet to eight feet above the floor generally distributed; and the temperature in such spaces when artificially heated shall not exceed 70 degrees Fahrenheit. The relative humidity shall not be less than 40 degrees nor more than 85 degrees.

(j) The word "auditorium" as used in this section in connection with buildings of Classes IV and V shall be construed as including the main floor, balcony and galleries.

(k) In buildings hereafter erected for or converted to the use of a factory, mill or workshop, the air shall be changed, except as hereinafter provided, so as to provide each person for whom working accommodations are provided therein with at least 1,500 cubic feet of air per hour.

(l) In buildings used for the purposes of a factory, mill or workshop at the time of the passage of this ordinance, the air shall be changed, except as hereinafter provided, so as to provide each person for whom working accommodations are provided therein with at least 1,200 cubic feet of air per hour.

(m) In any building or room hereafter erected for or converted to the use of a factory, mill or workshop the amount of carbon dioxide in the air, except as hereinafter provided, shall not be permitted to rise above ten parts of carbon dioxide per 10,000 parts of air.

(n) In buildings or rooms used for the purpose of a factory, mill or workshop at the time of the passage of this ordinance, the amount of carbon dioxide in the air, except as hereinafter provided, shall not be permitted to rise above twelve parts of carbon dioxide per 10,000 parts of air. The measurements in each case above enumerated in this paragraph shall be taken at levels from two and one-half feet to eight feet above the floor, distributed generally; and the temperature in such spaces, when artificially heated, shall not exceed 68 degrees Fahrenheit, except as hereinafter provided; the relative humidity shall not be less than 40 degrees nor more than 85 degrees.

(o) The above provisions and standards as to ventilation shall not apply to storage rooms or vaults or any place where the manufacturing processes therein conducted would be materially interfered with, or where manufacturing processes therein conducted would produce considerable quantities of free carbon dioxide, except that the air in such rooms or vaults or in any places of manufacture shall not be permitted to become detrimental to the health of those who enter or work therein.

(p) No part of the fresh air supplied in compliance with the requirements of this section shall be taken from any cellar or basement.

(q) No person, firm or corporation, either as owner, proprietor, lessee, manager or superintendent of any factory, mill, workshop or any other building where one or more persons are employed, shall cause, permit or allow the same or any portion or apartment of any room in such factory, mill or workshop, to be overcrowded or to have inadequate, faulty or insufficient light or ventilation.

(r) No person shall be exposed to any direct draft from any air inlet, nor to any draft having a temperature of less than sixty degrees.

(s) All poisonous or noxious fumes or gases arising from any process, and all dust of a character injurious to the health of the persons employed, which is created in the

course of a manufacturing process, within such factory, mill, workshop or laundry, shall be removed, as far as practicable, by either ventilating or exhaust devices.

ARTICLE XXI.

Elevators and Their Enclosing Walls.

681. Elevators—Passenger and Freight—Permit for Construction—Fee—Penalty.)

(a) Before proceeding with the construction or alteration of any passenger or freight elevator, except such as are hereinafter specially exempted from the provisions of this chapter, a permit for such construction or alteration shall be obtained from the Commissioner of Buildings either by the owner or agent of the building in which such elevator is to be constructed or in which such alterations are to be made, or by the contractor who is about to construct or alter such elevator.

(b) It shall be unlawful for any such owner, agent, or contractor to permit or allow the construction of any such elevator or the making of such alterations, or to proceed with or in or about any of the work of construction or alteration of any such elevator until such permit shall first have been obtained. Such permit shall be issued by the Commissioner of Buildings after application shall have been made to him therefor by any such owner, agent or contractor, specifying the number and kind of elevators which it is desired to construct, or the nature of the alterations to be made and the location of the building or structure in which the same is or are to be placed or made. Such application shall be accompanied with such plans and specifications as shall be necessary to advise and inform said Commissioner of the plan of construction, type of elevator, kind of alterations and the location thereof. If such plans and specifications shall show that such elevator or elevators is or are to be constructed or erected or altered in conformity with the provisions of this chapter, the Commissioner shall approve the same and shall issue a permit to such applicant upon the payment of such applicant of a fee of two dollars for each elevator to be constructed, erected or altered, and such fee shall be known as a permit fee and shall not be held to cover the cost of any inspection which shall at any time thereafter be made of such elevator or elevators when constructed, or of any alterations made.

(c) All contractors or persons, firms, or corporations, engaged in the manufacture and work of installing iron doors on passenger or freight elevators, or of installing wire work enclosures around elevators shall secure a permit from the Commissioner of Buildings for the work on each such elevator, the fee for which shall be two dollars for each elevator.

(d) It shall be unlawful for any person, firm or corporation either as owner, lessee, contractor or agent of any building or structure in which any elevator or elevators are to be constructed or altered to proceed with said work without securing a permit as herein required for such construction or alteration, and no such permit shall be issued until such person, firm or corporation, lessee, contractor or agent shall have complied with all the requirements of this chapter.

682. Enclosure of Elevator Shafts in Non-Fireproof Buildings.) In all non-fireproof buildings hereafter erected all passenger elevators and all freight elevators, except such as are expressly excepted by this chapter, shall be inclosed in a wall of brick, tile or such incombustible material as may, from time to time, be approved by the Commissioner of Buildings as proper and suitable for the purpose; such inclosure shall extend from the foundation to the roof of such building, and shall be supported independently of the floor construction; provided, fur-

ther, however, that the provisions of this section shall not apply to any non-fireproof building which is equipped throughout on every floor and in every room thereof and in all stairways, platforms, elevator shafts, elevator hoistways and well holes with an automatic sprinkler system approved by the Fire Marshal.

683. Enclosure of Pits and Shafts in Basements.) In all buildings heretofore or hereafter erected, whenever any elevator shaft extends down into a basement or sub-basement, that portion thereof extending below the street level shall be inclosed in walls of brick, tile or other fireproof material, and the door openings in such inclosure shall be protected by incombustible doors. Where such elevator shafts do not extend down into the basement they shall be provided with fireproof pits at the lowermost floor level above which they serve, and such pits shall have no openings except for cables or other elevator equipment.

684. Enclosure of Dumb Water Shafts—Materials.) In all non-fireproof buildings hereafter erected, the dumb waiter shafts shall be inclosed with brick, tile, reinforced concrete, or cement plaster not less than two inches thick or metal studs and lath.

685. Doors—On Elevators.) In all elevator shafts which are herein required to be enclosed with fireproof walls, the door openings shall be equipped with doors of incombustible material, which shall be made to open from the outside by means of a key or other device satisfactory to the Commissioner of Buildings.

686. Hatch Doors—Freight Elevators.) Elevators, used exclusively as freight elevators constructed and in operation at the time of the passage of this ordinance need not have enclosing walls, but in all such cases there shall be at every floor through which such freight elevators pass automatic hatch closers or automatic doors, made in such manner that they will fully close each well hole when the temperature in such well hole exceeds 140 degrees Fahrenheit; and it shall be the duty of the owner, agent or person in possession, charge or control of a building in which such elevator is maintained to keep such hatch closers or doors at all times in good working order. Such automatic hatch closers shall be examined by the Commissioner of Buildings and the Fire Marshal and if said officials shall find that such doors will automatically close when the temperature at or near such doors exceeds 140 degrees Fahrenheit, and that the conditions of construction and operation of such doors or hatch closers are such that there is no reasonable probability of their getting out of order and failing to operate when required, and that in their construction or operation there is nothing that is likely to cause accidents to or interference with the elevator service in such hatch holes which they were intended to close, and that the building in which such freight elevator is in use is equipped with stairways, fire escapes and passenger elevators sufficient to offer ample means of escape from such building in case of fire, for all persons employed or for all persons in such building, then, and in such case only, shall the use of such hatch doors or closers be permitted. All freight elevators in non-fireproof buildings shall comply with the preceding requirements of this section, or shall have inclosing walls of incombustible or fireproof construction. Such elevators are to be inspected semi-annually and oftener when, in the opinion of the Commissioner of Buildings, such inspection is necessary and such fees shall be paid for said inspection as otherwise provided in said chapter.

687. Safety Device.) (a) Every passenger and freight elevator now in operation or hereafter installed, except such as are

hereinafter exempted from the provisions of this chapter, shall be provided with a speed governor and such other efficient device to secure the safe operation of such passenger or freight elevator, and to prevent the cab or car of such elevator from falling, and to secure the safety of the cab or car and its load in case it does fail, as may be required by the Commissioner of Buildings. Such speed governor and other devices shall be subjected to such a practical test as may be determined by the Commissioner of Buildings for the purpose of ascertaining the efficiency of such safety device.

(b) It shall be the duty of the Commissioner of Buildings to make such test of each and every device upon all elevators, and no elevator shall be permitted to be run until such test has been made.

(c) That whenever any accident shall occur causing injury to any person affecting life or limb, in or about an elevator, or while getting on or off an elevator, or in any way impairing the safety of the elevator, the same shall be reported at once by the owner, superintendent, lessee or manager of the building, or the operator of the elevator, to the Commissioner of Buildings. No broken or damaged part of such elevator shall be moved or displaced, or repairs made thereon, nor shall said elevator be operated until an investigation into such accident has been made by the Commissioner of Buildings or his duly authorized agent. A full report in writing of the result of each investigation shall be filed in the Department of Buildings, and the Commissioner of Buildings shall keep a complete record of all such accidents and reports thereon.

(d) It shall be unlawful for any operator of any elevator in the City of Chicago wherein passengers are conveyed to start such elevator until all doors of such elevator and leading into such elevator shall be closed. It shall be unlawful for any such operator to open the doors of such elevator until said elevator has come to a full stop.

(e) Any person violating any of the provisions of this section shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense.

*Amended (by adding paragraphs (c), (d) and (e)) April 28, 1913.

***688. Safeguards for Elevators.)** (a) Where the counterweights travel in the same hatchway with an elevator car, the portion of the car contiguous to the weights shall be protected from the top to the bottom of the car by a suitable guard.

(b) All freight elevators shall be provided with a guard at least six feet high. All elevator cabs or cars, whether used for freight or passengers, shall be provided with some device whereby the car or cab may be held in the event of accident to the shipper rope or hoisting machinery or controlling apparatus.

(c) No passenger elevator hereafter erected shall be installed with a freight compartment either below or above the car.

(d) All hoistways, hatchways, elevator wells and wheel holes in any building, whether occupied or vacant, shall be securely fenced, inclosed or otherwise safely protected, and it shall be the duty of the owner, occupant or agent of any such building to keep all such means of protection closed at all times, except when it is necessary to have the same open, in order that the said hatchways, elevators or hoisting apparatus may be used.

*Amended February 2, 1911.

(e) It shall be unlawful to erect or maintain an elevator where such elevator or its counterweight descends into any passageway or thoroughfare.

(f) There shall be directly under the sheaves at the top of every elevator hatchway, a grating of steel or heavy wire mesh properly supported by steel or iron and capable of sustaining a load of not less than 500 pounds.

(g) All counterweights hereafter installed shall have their component parts so

fastened together as to prevent any piece or pieces from becoming detached from the guides should the counterweights be accidentally drawn to the top of the hatchway.

(h) Where drum counterweight cables run through or pass by the car counterweights to weights underneath, they shall be provided with a suitable covering to prevent their chafing and wearing on the counterweights.

(i) Where elevators other than hand-boosts and sidewalk elevators are not inclosed with fireproof or incombustible material, as is elsewhere herein specified in this Article, the well-hole of such elevator shall be enclosed with a wire guard not less than six feet high. The counterweights and the immediate space through which they travel must be protected from the floor to the ceiling with a wire guard or with other incombustible material. There must be on all elevators hereafter constructed a clear space of not less than two feet between the bottom of the hatchway and the level of the lower floor landing when the car is at its lowest position, and there must be a clearance of at least four feet from the top of the crossbeam of the car to the lower side of the grating under the overhead sheaves. Whenever there is conflict in regard to the manner of enclosing any elevator shaft or portion thereof between this section and Sections 682, 683 and 684, the provisions of the latter sections shall prevail.

(j) All passenger and freight elevators hereafter installed, except sidewalk or hand elevators, shall have an artificial traveling gas or electric light attached to the car and maintained in good working condition.

(k) All power driven elevators hereafter constructed or installed shall have at least two hoisting cables for the cage and two cables for each counterweight. The lifting and counterweight cables shall have at least one full turn of the cable on the drum when the car has run its limit.

(l) It shall be unlawful to change a hand-boost to a power-driven elevator without first making application to the Commissioner of Buildings for a permit for such change, and it shall be unlawful to connect an electric motor or any other appliance to the hand elevator machinery without the approval of the Commissioner of Buildings.

(m) All elevators, except hand elevators operated by a pulley rope and sidewalk ram or chain hoist elevators, and elevators used in tunnels for freight service only, shall be equipped with a safety speed governor.

(n) Where ropes or cables are used to operate safety devices, a weight shall be properly attached to the same in such a manner as to insure the necessary tension on such rope or cables for proper performance of the safety devices.

(o) All elevators propelled by electricity shall be provided with an additional device not operated by a link belt or sprocket chain which will automatically stop the elevator machinery when the car has reached its limit of travel. It shall be unlawful to construct or maintain any elevator equipped with a sprocket chain or link belt device or devices connecting the operating device and controller.

(p) An emergency switch which will disconnect the current shall be provided in all passenger elevators hereafter installed which are operated by an electric controller car switch, and such cars shall be so constructed that they will automatically stop when the current is disconnected.

(q) The underside of the floors or other parts of a building which project into passenger elevator shafts shall be equipped with a smooth steel guard curved and sloped from the enclosure of said elevator to the edge of such projection for the width of

the door to such elevator car and the slope of the guard plate shall not be less than sixty degrees with the horizon.

(r) The provisions of this section requiring the equipment of elevators with safety devices shall not apply to any hand hoists, elevator or hoist used solely for hoisting materials or tools in any building in course of construction, but the Commissioner of Buildings shall make such reasonable requirements as he may deem necessary for public safety in the operation of such hand hoists, elevators or hoists used solely for hoisting materials or tools in such buildings while under construction.

689. Inspection—Test—Certificate to Be Posted.) (a) Every elevator now in operation or which may be hereafter installed, together with the hoistway and all equipment thereof, shall be inspected under and by the authority of the Commissioner of Buildings at least once every six months, and in no case shall any new elevator be placed in operation until an inspection of the same has been made.

(b) It shall be the duty of every owner or agent, lessee or occupant of any building wherein any elevator is installed and the person in charge or control of any elevator to permit the making of a test and inspection of such elevator or elevators and all devices used in connection therewith upon demand being made by the Commissioner of Buildings or by a duly authorized Elevator Inspector within five days after such demand has been made.

(c) Whenever any such elevator has been inspected and the tests herein required shall have been made of all safety devices with which such elevator is required to be equipped and the result of such inspection and tests shows such elevator to be in good condition, satisfactory to the Commissioner of Buildings, and that such safety devices have been provided in accordance with the requirements of this chapter and are in good working condition and in good repair, it shall be the duty of the Commissioner of Buildings to issue or cause to be issued a certificate setting forth the result of such inspection and tests and containing the date of inspection, the weight which the elevator will safely carry and a statement to the effect that the shaft doors, hoistway and all equipment, including safety devices, are constructed in accordance with the provisions of this chapter, upon the payment of the inspection fee required by this chapter.

(d) It shall be the joint duty of the owner, agent, lessee or occupant of the building in which such elevator is located and of each person in charge or control of such elevator to frame the certificate and place same in a conspicuous place in each elevator.

(e) The words "safe condition" in this section shall mean that it is safe for any load up to the amount of weight named in such certificate.

(f) Where the result of such inspection or tests shall show such elevator to be in an unsafe condition or in bad repair, or shall show that the safety devices, or any of them, which are required by this chapter, have not been installed, or if installed, are not in good working order or not in good repair, such certificate shall not be issued until such elevator, its hoistway and its equipment or such device or devices shall have been put in good working order, satisfactory to the Commissioner of Buildings. The inspection fees herein required shall be paid either at the time application is made for inspection or upon the completion of such inspection and tests.

690. Power of Commissioner to Stop Operation of Elevators.) (a) Whenever any

building or elevator inspector finds any passenger or freight elevator or any of its running parts or automatic devices or other equipment out of order, or in an unsafe condition, he shall immediately report the same to the Commissioner of Buildings, together with a statement of all the facts relating to the condition of such elevator or elevators.

(b) It shall be the duty of the Commissioner of Buildings upon receiving from any inspector a report of the unsafe condition of any elevator, to order and cause such elevator not to be used until the same shall have been placed in a safe condition, and it shall be unlawful for any owner, agent, lessee, or occupant of any building, wherein any such passenger or freight elevator is located within the city, to permit or allow any such elevator to be used after the receipt of a notice in writing from the Commissioner of Buildings that any such elevator is out of order or is in an unsafe condition and until said elevator has been put in a safe and proper condition as required by the provisions of this chapter.

Article XXII, from Section 691 to 694, pertains to storage of oil. It is believed that this matter is not of much interest to architect and so it has been omitted from this issue.

ARTICLE XXIII.

Billboards, Signboards, Signs, and Fences.

695. Billboards and Signboards on Buildings—Construction—Height.) No billboard or signboard shall be erected or placed upon or above the roof of any building or structure within the limits of the City of Chicago; and it shall be unlawful for any person, firm or corporation to attach any billboard or signboard to the front, sides, or rear walls of any building, unless the same shall be placed flat against the surface of the building and safely and securely anchored or fastened thereto in a manner satisfactory to the Commissioner of Buildings.

696. Size and Construction of Billboards and Signboards Erected Within Fire Limits Otherwise Than on Buildings.) The face of billboards or signboards erected within the fire limits as now defined or as they may hereafter be defined by ordinances of the City of Chicago other than signboards and billboards referred to in Section 698 hereof, shall not exceed twelve feet in height, and the same shall be constructed of galvanized iron or some other equally incombustible material, except that the stringers, uprights and braces thereof may be of wood. All such billboards or signboards shall be securely anchored or fastened so as to be safe and substantial.

697. Height and Distance From the Ground of Billboards and Signboards Erected Within the Fire Limits.) It shall be unlawful for any person, firm or corporation to construct or erect any billboard or signboard, except those specified in Section 698 hereof, within the fire limits of the City of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street or streets has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The face of every billboard or signboard within the fire limits shall be of incombustible material, but the supports and framework of the same shall be of wood. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the

adjoining street. If, however, the level of the ground where the billboard or signboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. Every said billboard or signboard must be constructed and located in accordance with the provisions of this Article and shall be subject to the approval of the Commissioner of Buildings.

***698. Wooden Billboards or Signboards—Construction—Size—Exceptions.)** Billboards or signboards not exceeding *twenty-four (24)* square feet in area *when attached to the front, sides, or rear walls of any building, so that the flat surface of same is against the building, or when erected in the ground, if not erected nearer than ten feet to any building, structure, other signboard or public sidewalk, which are used to advertise the sale or lease of the property upon which they shall be erected,* may be built of wood or other combustible material, and such billboards or signboards shall be exempt from the provisions of this article, except that they shall be safely and securely anchored or fastened and shall be so constructed, anchored and fastened that they will withstand the wind pressure specified in Section 703 of this Article. It shall be unlawful to erect any such billboard or signboard exceeding *twenty-four (24)* square feet in area before a permit therefor has been procured from the Commissioner of Buildings, the application for which must include the plans and specifications of such board and its supports and fastenings.

*Amended November 18, 1911.

699. Billboards and Signboards Erected Outside the Fire Limits—Construction—Size.) It shall be unlawful for any person, firm or corporation to construct, erect or locate any billboard or signboard, except those specified in Section 698 hereof, outside the fire limits of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. The braces, supports and face of the billboard or signboard outside the fire limits may be made of wood, unless the billboard or signboard shall be erected or located so that any part of the face of said board is nearer than ten feet to any building or structure in which case the face of the same shall be constructed with incombustible material. Every such billboard or signboard shall be safely and securely constructed, anchored, fastened and located in accordance with the provisions of this article and shall be subject to the approval of the Commissioner of Buildings.

700. Provisions of This Article Shall Apply to Other Similar Structures.) The provisions of this article shall apply to other similar structures of like size and construction without regard to their use whether erected on or near the surface of the ground or anchored to, or fastened to any building or structure.

701. No Billboard or Signboard Shall be Erected Without Permit.) No billboard or signboard or other similar structure such as

is described in this article shall be erected or maintained within the city unless a permit shall first have been secured by the person, firm or corporation desiring to erect or maintain such billboard or signboard from the Commissioner of Buildings to whom application for such permit shall be made; and such application shall be accompanied by such plans and specifications of the proposed billboard or signboard and location of same as are necessary to fully advise and acquaint the said Commissioner with the construction of such proposed billboard or signboard. If the plans and specifications accompanying such application shall be in accordance with the provisions of this article, said Commissioner shall thereupon issue a permit for the erection of such billboard or signboard upon the payment by the applicant of a fee as hereinafter fixed.

702. Alteration and Repair of Billboards and Signboards.) No material alteration of any billboard or signboard nor removal from one location to another shall be made except upon a written permit issued by the Commissioner of Buildings authorizing such alteration or removal; and such permit shall be issued upon application in writing made to such Commissioner by the owner of such billboard or signboard or by the person in charge, possession or control thereof, accompanied by a plan of the proposed alterations or repairs to be made and a written statement covering the proposed removal from one location to another and its reconstruction in the new location, which said alteration and repairs or removal shall be made in accordance with the provisions of this article and the ordinances of the City of Chicago. Where such plans, specifications and location are in compliance with the requirements of this article and are satisfactory to and approved by the Commissioner of Buildings, such Commissioner shall issue a permit upon the payment of a fee therefor as hereinafter fixed; but such alteration shall not be construed to apply to the changing of any advertising matter of any billboard or signboard, nor the refacing of the framework supporting same.

703. Wind Pressure—Strength—Billboards Now Existing or Hereafter Constructed.) All billboards and signboards now in existence, or hereafter to be constructed, erected or maintained, shall be made, constructed, erected and maintained of sufficient strength to withstand a wind pressure of twenty-five pounds per square foot of surface without stressing the material beyond the safe limit of stress given elsewhere in this chapter.

704. Changes in Existing Billboards and Signboards.) No surface billboard or signboard constructed or erected prior to the passage of this ordinance shall be maintained after six months from and after the passage of this ordinance where the height of such billboard or signboard exceeds seventeen feet, nor shall such billboard or signboard be maintained after such date, unless there is a clear space of at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard or signboard is erected or maintained is above the level of the street then there must be a clear space of at least three feet between the bottom or face of the billboard or signboard and the level of the ground at the point where the billboard or signboard is erected or maintained.

705. Duty of Commissioner—Owner's Name to Be Placed on Top of Billboard or Signboard—Annual Inspection.) It shall be the duty of the Commissioner of Buildings to inspect all plans and specifications submitted in connection with the erection or construction or the alteration or repair of any billboard or signboard and to approve same if the method of construction and provisions made for fastening, securing, anchor-

ing and maintaining such billboard or signboards as such as will serve to protect the public and to render such billboards safe and substantial. It is further made the duty of the Commissioner of Buildings to exercise supervision over all billboards and signboards erected or being maintained under the provisions of this article; and to cause inspection by inspectors in his department of all such billboards and signboards to be made once each year and oftener where the condition of such boards so require; and whenever it shall appear to said Commissioner that any such billboard or signboard has been erected in violation of this ordinance or is in an unsafe condition or has become unstable or insecure or is in such a condition as to be a menace to the safety or health of the public, he shall thereupon issue or cause to be issued a notice in writing to the owner of such billboard or signboard or person in charge, possession or control thereof, if the whereabouts of such person is known, informing such person, firm or corporation of the violation of this ordinance and the dangerous condition of such billboard or signboard and directing him to make such alterations or repairs thereto, or to do such acts or things, as are necessary or advisable to place such billboard or signboard in a safe, substantial and secure condition and to make the same comply with the requirements of this ordinance within such reasonable time as may be stated in said notice. If the owner or person in charge, possession or control of any billboard or signboard when so notified shall refuse, fail, or neglect to comply with and conform to the requirements of such notice, said Commissioner shall, upon the expiration of the time therein mentioned, alter, change, tear down or cause to be torn down such part of such billboard or signboard as is constructed and maintained in violation of this ordinance, and shall charge the expense to the owner or person in possession, charge or control of such billboard or signboard which shall be recovered from them by appropriate legal proceedings. If the owner of such billboard or signboard or the person in charge, possession or control thereof cannot be found, or his or their whereabouts cannot be ascertained, the Commissioner shall attach or cause to be attached to said billboard or signboard, a notice of the same import as that required to be sent to the owner or person in charge, possession or control thereof, where the owner is known; and if such billboard or signboard shall not have been made to conform to this ordinance and be placed in a secure, safe and substantial condition, in accordance with the requirements of such notice, within thirty days after such notice shall have been attached to such billboard or signboard, it shall be the duty of the Commissioner of Buildings to thereupon cause such billboard or signboard or such portion thereof as is constructed and maintained in violation of this ordinance to be torn down; provided that nothing herein contained shall prevent the Commissioner of Buildings from adopting such precautionary measure as may be necessary or advisable in case of imminent danger in order to place such billboard or signboard in a safe condition, the expense of which shall be charged to and recovered from the owner of such billboard or signboard or person in charge, possession or control thereof in any appropriate proceedings therefor. No permit shall be issued to any applicant for permission to erect a billboard or signboard unless such applicant shall agree to place and maintain on the top of such billboard or signboard the name of the person or corporation owning same or who is in charge, possession or control thereof. It shall be the duty of the Commissioner of Buildings to require that the name of the person or corporation own-

ing or in possession, charge or control of such billboard or signboard is placed upon such billboard or signboard forthwith upon the erection thereof and is kept thereon at all times such billboard or signboard is maintained; and in case the owner of such billboard or signboard or the person in charge, possession or control thereof shall fail or refuse to place and maintain such name on the same, they shall be subject to the penalty hereinafter provided for. Every person, firm or corporation engaged in the business of erecting billboards or signboards for the purpose of display advertising shall file with the Commissioner of Buildings within ninety days after the passage of this ordinance a full and complete report of the location and size of all existing billboards or signboards.

***706. Fees and Permits and Annual Inspection—Indemnifying Bond.)** (a) The fee to be charged for permits issued for the erection or construction of billboards or signboards or for the alteration thereof shall be two dollars for each twenty-five lineal feet of billboard or signboard erected or altered, and an annual inspection fee shall be charged every person, firm or corporation as owner, or in possession, charge or control of any billboard or signboard now in existence or hereafter to be erected, which shall be one dollar for each twenty-five lineal feet of billboard or signboard or fractional part thereof; provided, however, that where such signboard does not exceed sixty-five square feet in area and is attached to the surface of a permanent building in accordance with the provisions of Section 705 and is designed to give publicity to the business carried on within such building, and no part of said sign is more than eighteen feet above the average inside grade at the front of the building, no fees for erection or inspection shall be charged; but not more than one sign of sixty-five square feet shall be allowed for each twenty-five lineal feet of frontage, unless the fees for erection and inspection are paid as herein provided for.

*Amended November 18, 1914.

(b) Every person, firm or corporation engaged in the business of constructing and erecting billboards or signboards shall file with the City Clerk a penal bond, with sureties to be approved by the Commissioner of Buildings, in the sum of twenty-five thousand (\$25,000.00) dollars, conditioned that such person, firm or corporation shall faithfully comply with all the provisions and requirements of this ordinance with respect to the construction, alteration, location and safety of billboards or signboards and for the payment of the inspection fees required by said ordinance; and conditioned, further, to indemnify, save and keep harmless said City of Chicago and its officials from any and all claims, damages, liabilities, losses, actions, suits or judgments which may be presented, sustained, brought or secured against the City of Chicago or any of its officials on account of the construction, maintenance, alteration or removal of any of said billboards or signboards, or by reason of any accidents caused by or resulting therefrom.

707. Frontage Consents Required.) It shall be unlawful for any person, firm or corporation to erect or construct any billboard or signboard in any block on any public street in which one-half of the buildings on both sides of the street are used exclusively for residence purposes without first obtaining the consent in writing of the owners or duly authorized agents of said owners owning a majority of the frontage of the property on both sides of the street in the block in which such billboard or signboard is to be erected, constructed or located. Such written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the erection, construction or location of such billboard or signboard.

708. Penalty.) Any person, firm or corporation owning, operating, maintaining or in charge, possession or control of any billboard or signboard within the city, who shall neglect or refuse to comply with the provisions of this article, or who erects, constructs or maintains any billboard or signboard that does not comply with the provisions of this article shall be fined not less than twenty-five (\$25.00) dollars nor more than two hundred (\$200.00) dollars for each offense; and each day on which any such person shall permit or allow any billboard or signboard owned, operated, maintained or controlled by him to be erected, constructed or maintained in violation of any of the provisions of this article shall constitute a separate and distinct offense.

***709 Fences—Walls—Height of—Wind Resistance.)** No wooden fence shall be constructed of greater height than eight feet above the sidewalk grade or eight feet above the surface of the ground where no grade is established. No fence of any other material shall be constructed on a lot alongside a street or alley or within eight feet of such street or alley and parallel thereto of greater height than eight feet above the surface of the street or alley where a grade is established or eight feet above the surface of the street or alley where no grade is established. No single or isolated wall of any material whatever, which forms no part of a building or structure that may be lawfully erected, shall be constructed upon any portion of a lot where the distance from such wall to the lot line is less than the height of the wall, unless such isolated wall shall have lateral supports on at least one side of same with braces extending to the top of the wall and is so constructed that it shall be capable of resisting a horizontal wind pressure on every part of same twice as great as buildings under the provisions of this chapter must be designed to resist.

In all cases where a fence or wall has been or shall hereafter be erected contrary to the provisions of this section, the Commissioner of Buildings shall forthwith notify the owner or agent of the land on which same is located, or the contractor engaged in erecting same, and shall specify briefly in such notice in what manner such fence or wall violates the provisions of this ordinance, and the said Commissioner of Buildings shall require the person so notified to forthwith make such fence or wall conform to and comply with the provisions of this ordinance, specifying in such notice the time within which such work shall be done.

If at the expiration of the time set forth in the notice provided for in this section, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and shall not have torn down or changed the said fence or wall so as to conform to and comply with the provisions of this ordinance, the Commissioner of Buildings shall have authority and it shall be his duty to proceed forthwith to tear down, or cause to be torn down, such fence or wall or so much thereof as is being maintained or shall have been erected and constructed in violation of the provisions of this section, and the cost of such tearing down shall be charged to and recovered from the owner of such fence or wall or from the person for whom such fence or wall has been or is being erected.

*Amended February 24, 1913.

710. Illuminated and Other Roof Signs of Steel Skeleton Construction—Definition—General Requirements—Fees.) (a) Illuminated and other roof signs regulated by this section shall be defined as signs constructed, erected and maintained upon or over the roof of any building which have all or any part of its letters of which said signs may be constructed either in an outline of incandescent lamps or which have painted, flush or raised letters where the face of the sign presents a surface to be affected by wind pressure not in excess of the requirements hereinafter contained; or signs having a border of incandescent lights attached thereto and reflecting light thereon; or trans-

parent glass signs where they are lighted by electricity or other illuminant. Every such sign as hereinabove described shall be constructed with steel skeleton construction so as to present a surface to be affected by wind pressure which shall not exceed fifty per cent. of the face of the sign. No illuminated roof sign shall be erected or maintained upon or over the roof of any building unless the framework thereof shall be entirely of metal or some other equally incombustible material, and no material, except such material as is used for insulating wires and conductors, which is less combustible than metal, shall be used in, on or about, or comprise a part of any illuminated roof sign, except that the material to which the framework of any such sign shall be anchored, may be substantial beams anchored or securely fastened to the roof or walls of the buildings upon or over which any such sign is erected.

(b) The distance between the roof of said building or structure and the lower edge of such sign shall not be less than five (5) feet. The height of any such sign from the roof of the building or structure to which the same is anchored or attached shall not exceed sixty (60) feet. No such sign, hereafter erected, shall be constructed closer than six (6) feet from the edge of the roof of the building or structure upon which same is erected. No such illuminated roof sign shall be constructed on any building or structure which is over eight stories in height. Any illuminated roof sign, less than twelve (12) feet in height, shall be exempt from the provisions of this section and shall be held to be governed by the ordinances of the City of Chicago relating to billboards and signboards. No illuminated roof sign, such as is described in this section, shall be constructed, erected, maintained or put in place until the person, firm or corporation desiring to construct, erect, maintain or put in place such sign shall have made application in writing to the Commissioner of Buildings for permission so to do, submitting with such application plans and specifications showing the size, nature and construction of the sign proposed to be erected, and shall present to the City Electrician plans showing the insulation, location and construction of the electrical part of such sign. If the Commissioner of Buildings shall be of the opinion that such sign, if erected, constructed and maintained in accordance with the plans and specifications so submitted, shall be safe and secure, he shall approve the application so submitted, providing the plans bear the approval of the City Electrician, and the Commissioner of Buildings shall note his approval upon such plans and specifications and keep a copy thereof at all times on file in his office. All signs shall be constructed, erected and maintained of sufficient strength to withstand a wind pressure of not less than thirty pounds per square foot of surface without stressing the material beyond the safe limits of stress given elsewhere in this chapter. It shall be the duty of the Commissioner of Buildings to cause his building inspector or inspectors to make an inspection annually of each illuminated roof sign erected or constructed or being maintained under the provisions of this ordinance for the purpose of ascertaining whether such sign is safely and securely constructed and so anchored and fastened to the building or structure; provided, however, that the provisions of this section shall not apply to the erection, construction and maintenance of signboards and billboards as regulated by the ordinances of the City of Chicago.

(c) Any person, firm or corporation desiring to erect or maintain an illuminated

roof sign, as described in this ordinance, shall pay to the city, to cover the cost of the inspection and approval by the Commissioner of Buildings of the plans and specifications of such sign, when erected, a fee of fifty dollars (\$50.00) for the first five hundred (500) square feet of superficial area of such sign or fractional part thereof, and for each additional square foot two cents (2c). For each annual inspection by the Commissioner of Buildings subsequent to the first inspection there shall be paid a fee of fifty dollars (\$50.00) for each illuminated roof sign. In addition to the fees herein required to be paid for inspection by the Commissioner of Buildings, there shall be paid by the owner or person having charge or control of any illuminated roof sign, as herein described, an annual inspection fee to cover the cost of such inspection which shall be made by the City Electrician, and such fee shall be at the rate provided by the ordinances of Chicago.

(d) Every illuminated roof sign erected, constructed or maintained under the provisions of this ordinance shall have the name of the owner thereof placed thereon in a legible and conspicuous manner. No person, firm or corporation shall be permitted to erect or maintain an illuminated roof sign unless he shall execute and file with the City Clerk of Chicago, with sureties to be approved by the Commissioner of Buildings, a bond to the City of Chicago in the penal sum of fifteen thousand dollars (\$15,000.00), conditioned to indemnify, save and keep harmless the City of Chicago, and its officers and agents, from any damage which it, the said city, or any of said officers, may suffer, or from any costs, liability or expense of any kind whatsoever which it, the said city, or any of its officers, may be put to or which may be recovered against the said city, or any of its officers, from or by reason of the construction, erection and maintenance of such sign, and conditional further to faithfully observe and perform all the provisions and conditions of this ordinance and of any ordinance now in force or which may hereafter be passed by the City Council of the City of Chicago, relating to or governing the erection, maintenance, use or inspection of illuminated roof signs.

(e) The permission and authority granted by this ordinance shall cease at any time hereafter at the discretion of the Mayor. In case of the termination of the privileges herein granted by the exercise of the Mayor's discretion as aforesaid, all such electrical signs erected by virtue of the authority conferred by this ordinance, shall be removed at the expense of the owner or owners of the building or the person, firm, corporation or individual who are then maintaining same without any cost or expense of any kind whatsoever to the City of Chicago, provided that in the event of the failure, neglect or refusal on the part of the owner of the building or structure upon which said illuminated electric sign is constructed or the person, firm, corporation or individual operating and maintaining said electric sign to remove said electric sign upon the revocation of the permit by the Mayor as herein provided, the Commissioner of Buildings may proceed to remove same and charge the expense thereof to the owner of the building or structure upon which said illuminated electric sign is constructed or the person, firm, corporation or individual operating or maintaining same.

(f) Any person, firm or corporation who shall erect, construct or maintain an illuminated roof sign in violation of any of the provisions of this section shall be fined not less than fifty dollars (\$50.00) nor more than two hundred dollars (\$200.00) for each offense.

ARTICLE XXIV.

Frontage Consents.

711. Definition of Word "Block" as Used in This Chapter.) Whenever a provision is made in this chapter that frontage consents shall be obtained for the erection, construction, alteration, enlargement or maintenance of any building or structure in any block, the word "block," so used, shall not be held to mean a square, but shall be held to embrace only that part of a street bounding the square which lies between the two nearest intersecting streets, one on either side of the point at which such building or structure is to be erected, constructed, altered, enlarged or maintained, unless it shall be otherwise specifically provided.

***712. Frontage Consents—Gas Reservoir—Packing House—Rendering Plant—Soap Factory—Tannery—Blacksmith Shop—Foundry—Smelter—Metal Refinery—Machine Shop—Factory, Etc.—Laundry, Etc.—Livery Stable—Boarding Stable—Sale Stable—Medical Dispensary—Second-hand Store or Yard—Smoke House.)** It shall be unlawful for any person, firm or corporation to locate, build, construct or maintain on any lot fronting on any street or alley in the city in any block in which one-half of the buildings on both sides of the street are used exclusively for residence purposes, or within fifty feet of any such street, any building or place used for a gas reservoir, packing house, rendering plant, soap factory, tannery, blacksmith shop, foundry, smelter, metal refinery, machine shop, factory combined with a foundry, laundry to be run by machinery, livery stable, boarding stable, sale stable, medical dispensary, second-hand store or yard, smoke house or place where fish and meats are smoked or cured, without the written consent of a majority of the property owners according to frontage on both sides of such street or alley. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building or place for any of the above purposes; provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street and located upon a corner lot shall not be considered.

*Section 712 re-written and passed November 8, 1915.

712a. Frontage Consents—For What Required.) It shall be unlawful for any person, firm or corporation to locate, build or construct any store for the sale at retail of goods, wares and merchandise, on any street in any block in which all the buildings are used exclusively for residence purposes, without first securing and filing with the Commissioner of Buildings the written consent of a majority of the property owners according to frontage on both sides of the street in the block in which the building to be thus used is located; provided, in determining whether all the buildings in the said block are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

713. Reformatory—Sheltering Institutions.) (a) It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage any reformatory, rescue or sheltering institution in any block or square in which one-half of the buildings on both sides of the street or streets on which the proposed reformatory, rescue or sheltering institution may front are used exclusively for residence purposes without the written consent of a majority of the property owners, according to frontage on both sides of the streets bounding such block. Such written consent shall be

obtained and filed with the Commissioner of Buildings before a permit is issued for the construction, alteration, or maintenance of such building.

(b) Provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

***714. Permit for Moving Frame Buildings—Requirements—Written Consents Must Be Obtained—Affidavits Made—Space Occupied on Lot.)** (a) No person, firm or corporation shall be permitted to move any building which has been damaged to any extent greater than 50% of its value by fire, decay or otherwise; nor shall be permitted to move any frame building of such a character as is prohibited to be constructed within the fire limits from any point outside the fire limits to any point within the fire limits; nor shall be permitted to move any building to a location at which the uses for which such building is designed are prohibited by ordinance. Permits for the moving of frame buildings, other than those the moving of which is herein prohibited, shall be granted upon the securing and filing the written consent of two-thirds of the property owners according to frontage on both sides of the street in the block in which such building is to be moved. No permit shall be issued to move any building used or designed to be used for purposes for which frontage consents are required until frontage consents in the block to which such building is to be moved have also been secured and filed as required by the ordinances relating to such use.

(b) No building used for residence or tenement house purposes shall be moved from one lot to another or from one location to another upon the same lot unless the space to be occupied on such lot shall comply with the provisions of Section 410 of this chapter.

*Amended March 23, 1914.

(c) No frontage consent shall be required of any person, firm or corporation for removing a building upon his own premises and not going upon the premises of any other person, or upon any street, alley or other public place, in making such removal.

715. Amusements—Frontage Consents Required.) It shall be unlawful for any person, firm or corporation to construct or erect any building designed or intended to be used for the purpose of presenting or carrying on therein any entertainment for which a license is required by the ordinances of the City of Chicago without first obtaining the written consent of the property owners as required by the City ordinances.

***716. Garages—Frontage Consents Required.)**

It shall be unlawful for any person, firm or corporation to locate, build, construct or maintain any garage within two hundred feet of any building used as and for a hospital, church or public or parochial school, or the grounds thereof, and it shall be unlawful for any person, firm or corporation to locate, build, construct or maintain any garage in the city in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, or within one hundred feet of any such street in any such block, without securing the written consent of a majority of the property-owners, according to frontage on both sides of the street as provided by the ordinances of the City of Chicago.

Any person violating any of the provisions of this ordinance shall be fined not less than five dollars nor more than one hundred dollars for each offense, and his license shall be subject to revocation by the Mayor.

*Re-passed July 17, 1911, in accordance with court decision, and Sec. 716, Code 1911, repealed.

See also ordinance on page 189.

***717. Storage of Shavings and Sawdust in Buildings Used for Residence Purposes.)** No person, firm or corporation shall keep, pile, store or accumulate loose shavings,

excelsior, sawdust or other similar inflammable materials in any quantity, nor shall any such materials in bales be stored in any quantity exceeding 2,000 pounds in any building used wholly or in part for residence purposes.

***717½. Frontage Consents—Business of Selling Meats, Etc.)** It shall be unlawful for any person, firm or corporation to carry on the business of selling meats, poultry, fish, butter, cheese, lard, vegetables or any other provisions from any place of business located in any block in which all the other buildings are used exclusively for residence purposes, without first securing and filing with the City Collector of the City of Chicago the written consent of three-fourths of the property owners according to frontage on both sides of the street in the block in which the building to be thus used is located, provided in determining whether all the buildings in said block are used exclusively for residence purposes, any building fronting on another street and located upon a corner shall not be considered.

*Amended May 18 and June 9, 1914.

***717¾.** No permit shall be issued for the erection or remodeling of any building in any block in which the use of buildings is restricted or regulated by ordinance if such building is designed to be used for conducting therein any business or store, without first requiring the applicant for such permit to file with the Commissioner of Buildings a plat showing the use to which all the property in such block is devoted.

*Amended June 2, 1913, by adding Sec. 717¾.

ARTICLE XXV.

Fire Limits.

718. Fire Limits—Provisional Fire Limits.) (a) The fire limits of the City of Chicago, within which wooden buildings shall not be erected, shall be and they are hereby defined, as follows: All that part of the City of Chicago bounded by the following limits: Commencing at the intersection of the shore of Lake Michigan and the center line of Rogers avenue, thence southwesterly along the center line of Rogers avenue to the east line of the right of way of the Chicago and Northwestern Railway Company, thence south along the east line of said right of way of the Chicago and Northwestern Railway Company to a line 125 feet north of the north line of Foster avenue, thence west along said line 125 feet north of the north line of Foster avenue to the center line of the North Shore channel, thence southeasterly along the center line of said North Shore channel to the center line of the north branch of the Chicago river, thence northwesterly and westerly along the center line of said north branch of the Chicago river to a line 125 feet west of the west line of North Kedzie avenue, thence south along said line 125 feet west of the west line of North Kedzie avenue to a line 125 feet south of the south line of Irving Park boulevard, thence east along said line 125 feet south of the south line of Irving Park boulevard to the center line of the north branch of the Chicago river, thence northerly along the center line of the north branch of the Chicago river to a line 125 feet south of the south line of Montrose avenue, thence east along said line 125 feet south of the south line of Montrose avenue to a line 125 feet west of the west line of North Western avenue, thence south along said line 125 feet west of the west line of North Western avenue to the center line of Addison street, thence east along the center line of Addison street to the center line of North Western avenue, thence south along the center line of North Western avenue to the center line of Belmont avenue, thence east along the center line of Belmont avenue to the center line of Southport avenue, thence south along the center line of Southport avenue to the center line of Fullerton avenue, thence west along the center line of Fullerton avenue to

the center line of the north branch of the Chicago river, thence northwesterly along the center line of the north branch of the Chicago river to a line 125 feet north of the north line of Belmont avenue, thence west along said line 125 feet north of the north line of Belmont avenue to a line 125 feet west of the west line of North Kostner avenue, thence south along said line 125 feet west of the west line of North Kostner avenue to a line 125 feet north of the north line of Diversey avenue, thence west along said line 125 feet north of the north line of Diversey avenue to a line 125 feet west of the west line of North Cicero avenue, thence south along said line 125 feet west of the west line of North Cicero avenue to a line 125 feet north of the north line of Armitage avenue, thence west along said line 125 feet north of the north line of Armitage avenue to a line 125 feet northeasterly of the northeasterly line of West Grand avenue, thence northwesterly along said line 125 feet northeasterly of the northeasterly line of West Grand avenue to a line 125 feet north of the north line of Fullerton avenue, thence west along said line 125 feet north of the north line of Fullerton avenue to a line 125 feet northeasterly of the northeasterly line of West Grand avenue, thence northwesterly along said line 125 feet northeasterly of the northeasterly line of West Grand avenue to the center line of Harlem avenue, thence south along the center line of Harlem avenue to a line 125 feet southwesterly of the southwesterly line of West Grand avenue, thence southeasterly along said line 125 feet southwesterly of the southwesterly line of West Grand avenue to a line 125 feet south of the south line of Fullerton avenue, thence east along the said line 125 feet south of the south line of Fullerton avenue to a line 125 feet southwesterly of the southwesterly line of West Grand avenue, thence southwesterly along said line 125 feet southwesterly of the southwesterly line of West Grand avenue to the southerly line of the right of way of the Chicago, Milwaukee and St. Paul Railway Company, thence northwesterly and westerly along the southerly line of said right of way of the Chicago, Milwaukee and St. Paul Railway Company to the center line of Narragansett avenue, thence south along the center line of Narragansett avenue to the center line of West North avenue, thence east along the center line of West North avenue to the center line of North Central avenue, thence south along the center line of North Central avenue to the center line of Le Moyne street, thence west along the center line of Le Moyne street to the center line of North Menard avenue, thence south along the center line of North Menard avenue to the center line of Hirsch street, thence east along the center line of Hirsch street to the center line of Leclaire avenue, thence north along the center line of Leclaire avenue to the center line of West North avenue, thence east along the center line of West North avenue to a line 125 feet west of the west line of North Cicero avenue, thence south along said line 125 feet west of the west line of North Cicero avenue to a line 125 feet north of the north line of West Division street, thence west along said line 125 feet north of the north line of West Division street to the center line of North Austin avenue, thence south along the center line of North Austin avenue to a line 125 feet south of the south line of West Division street, thence east along said line 125 feet south of the south line of West Division street to the center line of North Laramie avenue, thence south along the center line of North Laramie avenue to the center line of West Chicago avenue, thence west along the center line of West Chicago avenue to the center line of North Austin avenue, thence south along the center line of North Austin avenue and South Austin avenue to the center line of West 12th street, thence east along the center line of West 12th street to the center line of

South Kenton avenue, produced north, thence south along the center line of South Kenton avenue, produced north, to the center line of West 22nd street, thence east along the center line of West 22nd street to the center line of South Kostner avenue, thence south along the center line of South Kostner avenue to the center line of West 33rd street, thence east along the center line of West 33rd street to the center line of South Crawford avenue, thence south along the center line of South Crawford avenue to the center line of the Illinois and Michigan Canal, thence north-easterly along the center line of the Illinois and Michigan Canal to the center line of South Western Avenue boulevard, thence south along the center line of South Western Avenue boulevard to the center line of West 39th street, thence east along the center line of West 39th street to the center line of South Robey street, thence south along the center line of South Robey street to the center line of West 43rd street, thence east along the center line of West 43rd street to a line 125 feet west of the west line of South Ashland avenue, thence north along said line 125 feet west of the west line of South Ashland avenue to the center line of West 41st street, thence east along the center line of West 41st street to the center line of South Ashland avenue, thence north along the center line of South Ashland avenue to the center line of West 40th street, thence east along the center line of West 40th street to a line 125 feet east of the east line of South Ashland avenue, thence south along said line 125 feet east of the east line of South Ashland avenue to the center line of West 43rd street, thence west along the center line of West 43rd street to the center line of South Ashland avenue, thence south along the center line of South Ashland avenue to the center line of West 47th street, thence east along the center line of West 47th street to a line 125 feet west of the west line of South Halsted street, thence south along said line 125 feet west of the west line of South Halsted street to the center line of West 51st street, thence west along the center line of West 51st street to the center line of South Racine avenue, thence south along the center line of South Racine avenue to a line 125 feet north of the north line of West 63rd street, thence west along said line 125 feet north of the north line of West 63rd street to the center line of South Western avenue, thence north along the center line of South Western avenue to the center line of West 55th street, thence west along the center line of West 55th street to the center line of South Rockwell street, thence south along the center line of South Rockwell street to the center line of West 59th street, thence west along the center line of West 59th street to the center line of South Kedzie avenue, thence south along the center line of South Kedzie avenue to a line 125 feet south of the south line of West 63rd street, thence east along said line 125 feet south of the south line of West 63rd street to the center line of South Rockwell street, thence south along the center line of South Rockwell street to the center line of West 66th street, thence east along the center line of West 66th street to the center line of South Western avenue, thence north along the center line of South Western avenue to a line 125 feet south of the south line of West 63rd street, thence east along said line 125 feet south of the south line of West 63rd street to the center line of South Racine avenue, thence south along the center line of South Racine avenue to the center line of West 75th street, thence west along the center line of West 75th street to a line 125 feet east of the east line of South Ashland avenue, thence north along said line 125 feet east of the east line of South Ashland avenue to the center line of West 71st street, thence west along the center line of West 71st street to a line 125 feet west of the west line of South Ashland avenue, thence south along

said line 125 feet west of the west line of South Ashland avenue to the center line of West 75th street, thence west along the center line of West 75th street to a line 125 feet west of the west line of South Robey street, thence south along said line 125 feet west of the west line of South Robey street to a line 125 feet north of the north line of West 79th street, thence west along said line 125 feet north of the north line of West 79th street to a line 125 feet west of the west line of South Western avenue, thence south along said line 125 feet west of the west line of South Western avenue to a line 125 feet south of the south line of West 83rd street, thence east along said line 125 feet south of the south line of West 83rd street to the center line of South Winchester avenue, thence south and southeasterly along the center line of South Winchester avenue to the northeastern boundary line of the right-of-way of the Chicago, Rock Island & Pacific Railway Co., in South Hermitage avenue, thence southeasterly in South Hermitage avenue along said northeastern boundary line of the right-of-way of the Chicago, Rock Island & Pacific Railway Co., to the center line of West 91st street, thence east along the center line of West 91st street to a line 125 feet west of the west line of South Ashland avenue, thence south along said line 125 feet west of the west line of South Ashland avenue to a line 125 feet south of the south line of West 95th street, thence east along said line 125 feet south of the south line of West 95th street to a line 125 feet east of the east line of Vincennes avenue, thence northeasterly along said line 125 feet east of the east line of Vincennes avenue to a line 125 feet north of the north line of West 90th street, thence west along said line 125 feet north of the north line of West 90th street to the center line of South Racine avenue, thence north along the center line of South Racine avenue to a line 125 feet south of the south line of West 83rd street, thence east along said line 125 feet south of the south line of West and East 83rd street to a line 125 feet west of the west line of South Park avenue, thence south along said line 125 feet west of the west line of South Park avenue to a line 125 feet north of the north line of East 95th street, thence west along said line 125 feet north of the north line of East and West 95th street to a line 125 feet west of the west line of South State street, thence south along said line 125 feet west of the west line of South State street to a line 125 feet south of the south line of West 99th street, thence east along said line 125 feet south of the south line of West 99th street and East 99th street to a line 125 feet west of the west line of South Michigan avenue, thence south along said line 125 feet west of the west line of South Michigan avenue to a line 125 feet north of the north line of East 119th street, thence west along said line 125 feet north of the north line of East and West 119th street to a line 125 feet west of the west line of South Morgan street, thence south along said line 125 feet west of the west line of South Morgan street to a line 125 feet south of the south line of West 119th street, thence east along said line 125 feet south of the south line of West and East 119th street to a line 125 feet east of the east line of South Michigan avenue, thence north along said line of 125 feet east of the east line of South Michigan avenue to a line 125 feet south of the south line of East 99th street, thence east along said line 125 feet south of the south line of East 99th street to a line 125 feet west of the west line of South Park avenue, thence south along said line 125 feet west of the west line of South Park avenue to the center line of East 115th street, thence east along the center line of East 115th street to the northeasterly line of the right of way of the Michigan Central Railroad Company, thence south and southeasterly along said northeasterly line of the right of way of the Michigan Central Railroad Company to the center line of East 127th street, thence east along the center line of East 127th street to

the shore line of Lake Calumet, thence northwesterly and northeasterly along the shore line of said Lake Calumet to a line 125 feet east of the east line of Stony Island avenue, thence north along said line 125 feet east of the east line of Stony Island avenue to a line 125 feet north of the north line of East 95th street, thence west along said line 125 feet north of the north line of East 95th street to a line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company, thence northeasterly along said line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company to a line 125 feet south of the south line of East 79th street, thence east along said line 125 feet south of the south line of East 79th street to the center line of Brandon avenue, thence south along the center line of Brandon avenue to the center line of East 83rd street, thence east along the center line of East 83rd street to the center line of Burley avenue, thence south along the center line of Burley avenue to the center line of East 89th street, thence west along the center line of East 89th street to a line 125 feet west of the west line of Manistee avenue, thence south along said line 125 feet west of the west line of Manistee avenue to the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railroad Company, thence southeasterly along said northeasterly line of the right of way of the Lake Shore and Michigan Southern Railroad Company to the easterly and southeasterly line of the South Chicago branch of the Pittsburgh, Fort Wayne and Chicago Railroad Company, thence southwesterly along said easterly and southeasterly line of the South Chicago branch of the Pittsburgh, Fort Wayne and Chicago Railroad Company to the center line of East 106th street, thence east along the center line of East 106th street to a line 200 feet east of the east bank of the Calumet river, thence north along said line 200 feet east of the east bank of the Calumet river to the center line of East 95th street, thence east along the center line of East 95th street to the shore of Lake Michigan, thence northerly and northwesterly along the shore of Lake Michigan to the place of beginning.

(h) Also, commencing at the intersection of the center line of Addison street and the center line of the north branch of the Chicago river, thence west along the center line of Addison street to the center line of North Whipple street, thence south along the center line of North Whipple street to the center line of Elston avenue, thence southeasterly along the center line of Elston avenue to the center line of Roscoe street, thence east along the center line of Roscoe street to the center line of the north branch of the Chicago river, thence north along the center line of the north branch of the Chicago river to the place of beginning.

(c-1) Also all of that territory bounded on the west by Stony Island avenue, thence along a line one hundred and twenty-five feet south of East 83rd street on the south, east to the center line of Yates avenue, thence north to a line one hundred and twenty-five feet south of East 70th street on the north, thence west to Stony Island avenue.

Amended, paragraph (c-1), June 19, 1916.

(c) Also commencing at the intersection of a line 125 feet north of the north line of West 50th street and 125 feet east of the east line of Rockwell street, thence west along said line 125 feet south of the south line of West 50th street to a line 125 feet west of the west line of South Kedzie avenue, thence north along said line 125 feet west of the west line of South Kedzie avenue to a line 125 feet north of the north line of West 53rd street, thence east along said line 125 feet north of the north line of 53rd street to a line 125 feet east of the east line of Whipple street, thence south along said line 125 feet east of the east line of Whipple street to a line 125 feet north of the north line of West 57th street, thence east along said line 125

feet north of the north line of West 57th street to a line 125 feet south of the east line of Rockwell street, thence east along said line 125 feet east of the east line of Rockwall street to the place of beginning.

(c) Excepting, the district bounded as follows: Commencing at the intersection of a line 125 feet south of the south line of Foster avenue and the center line of North Leavitt street, thence west along said line 125 feet south of the south line of Foster avenue to a line 125 feet east of the east line of North Western avenue, thence south along said line 125 feet east of the east line of North Western avenue to a line 125 feet east of the east line of Lincoln avenue, thence southeasterly along said line 125 feet east of the east line of Lincoln avenue to a line 125 feet north of the north line of Lawrence avenue, thence east along said line 125 feet north of the north line of Lawrence avenue to the center line of North Leavitt street, thence north along the center line of North Leavitt street to the place of beginning.

(d) Excepting, also, the district bounded as follows: Commencing at the intersection of a line 125 feet south of the south line of Belmont avenue and the center line of North Kedzie avenue, thence west along said line 125 feet south of the south line of Belmont avenue to the center line of North Crawford avenue, thence south along the center line of North Crawford avenue to the center line of Fullerton avenue, thence east along the center line of Fullerton avenue to the center line of North Central Park avenue, thence north along the center line of North Central Park avenue to the center line of Diversey avenue, thence east along the center line of Diversey avenue to the center line of North Kedzie avenue, thence north along the center line of North Kedzie avenue to the place of beginning.

(e) Excepting, also, the district bounded as follows: Commencing at the intersection of a line 125 feet south of the south line of Armitage avenue and a line 125 feet west of the west line of North Cicero avenue, thence west along said line 125 feet south of the south line of Armitage avenue to a line 125 feet northeasterly of the northeasterly line of West Grand avenue, thence southeasterly along said line 125 feet northeasterly of the northeasterly line of West Grand avenue to a line 125 feet west of the west line of North Cicero avenue, thence north along said line 125 feet west of the west line of North Cicero avenue to the place of beginning.

(f) Excepting, also, the district bounded as follows: Commencing at the intersection of the center line of West 40th street and the center line of Normal avenue, thence west along the center line of West 40th street to the center line of Wallace street, thence south along the center line of Wallace street to the center line of West 43rd street, thence west along the center line of West 43rd street to a line 125 feet east of the east line of South Halsted street, thence south along said line 125 feet east of the east line of South Halsted street to the center line of West 51st street, thence east along the center line of West 51st street to the center line of South Union avenue, thence south along the center line of South Union avenue to the center line of West Garfield boulevard, thence east along the center line of West Garfield boulevard to a line 125 feet west of the west line of Wentworth avenue, thence north along said line 125 feet west of the west line of Wentworth avenue to the center line of West 43rd street, thence west along the center line of West 43rd street to the center line of Normal avenue, thence north along the center line of Normal avenue to the place of beginning.

(g) Excepting, also, the district bounded as follows: Commencing at the center line of

West 43rd street and a line 125 feet west of the west line of South State street, thence west along the center line of West 43rd street to a line 125 feet east of the east line of Wentworth avenue, thence south along said line 125 feet east of the east line of Wentworth avenue to the center line of West Garfield boulevard, thence east along the center line of West Garfield boulevard to a line 125 feet west of the west line of South State street, thence north along said line 125 feet west of the west line of South State street to the place of beginning.

(h) Excepting, also, the district bounded as follows: Commencing at the intersection of the center line of West 52nd street and the center line of South Peoria street, thence west along the center line of West 52nd street to the center line of South Morgan street, thence south along the center line of South Morgan street to the center line of West 53rd street, thence east along the center line of West 53rd street to the center line of South Peoria street, thence north along the center line of South Peoria street to the place of beginning.

(i) Excepting, also, the following territory, which shall be known as a provisional fire limit district: Commencing at the intersection of the shore of Lake Michigan and the center line of Rogers avenue, thence southwesterly along the center line of Rogers avenue to the east line of the right of way of the Chicago & Northwestern Railway Company, thence south along the east line of the right of way of the Chicago & Northwestern Railway Company to the center line of Devon avenue, thence east along the center line of Devon avenue to the shore of Lake Michigan, thence northwesterly along the shore of Lake Michigan to the place of beginning.

(j) Excepting, also, the following territory, which shall be known as a provisional fire limit district: Commencing at the intersection of the shore line of Lake Michigan and the center line of East 67th street, thence west along the center line of East 67th street to the center line of Cottage Grove avenue, thence north along the center line of Cottage Grove avenue to the center line of East 63rd street, thence west along the center line of East 63rd street to the center line of South Park avenue, thence south along the center line of South Park avenue to the center line of East 67th street, thence west along the center line of East 67th street to the northeasterly line of the right of way of the Lake Shore & Michigan Southern Railroad Company, thence northwesterly along the northeasterly line of the right of way of the Lake Shore & Michigan Southern Railroad Company to the center line of South State street, thence south along the center line of South State street to the center line of East 75th street, thence east along the center line of East 75th street to the center line of Cottage Grove avenue, thence south along the center line of Cottage Grove avenue to a line 125 feet south of the south line of East 79th street, thence east along said line 125 feet south of the south line of East 79th street to the shore of Lake Michigan, thence northwesterly along the shore of Lake Michigan to the place of beginning.

(k) Excepting, also, the following territory, which shall be known as a provisional fire limit district: Commencing at the center line of East 87th street and a line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company, thence west along the center line of East 87th street to a line 125 feet west of the west line of South Park avenue, thence south along said line 125 feet west of the west line of South Park avenue to the center line of East 95th street, thence east along the center line of East 95th street to a line 125 feet east of the east line of the right of way

of the Illinois Central Railroad Company, thence northeasterly along said line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company to the place of beginning.

(d) The following described territory outside the above described fire limits is hereby established as a provisional fire limits district: Commencing at the intersection of the southwesterly line of the right of way of the Pittsburgh, Ft. Wayne and Chicago Railroad and a line 125 feet easterly of the easterly line of the right of way of the Illinois Central Railroad, thence southwesterly along said line 125 feet easterly of the easterly line of the right of way of the Illinois Central Railroad to the center line of East 83rd street, thence east along the center line of East 83rd street to the center line of Stony Island avenue, thence north along the center line of Stony Island avenue to the southwesterly line of the right of way of the Pittsburgh, Ft. Wayne and Chicago Railroad, thence northwesterly along the southwesterly line of the right of way of the Pittsburgh, Ft. Wayne and Chicago Railroad to the said line 125 feet easterly of the easterly line of the right of way of the Illinois Central Railroad, the place of beginning.

(m) Any person desiring to erect a frame or wooden building to be used for residence or mercantile purposes within the provisional fire limits above described shall have a right to do so, upon presenting a petition to the Commissioner of Buildings together with a plat, plans and specifications showing the place where such building is to be erected. Such petition shall be verified by the affidavit of the applicant and shall contain the written consent of the owners of a majority of the frontage upon both sides of the streets surrounding the square in which the building is to be erected.

(n) No frame or wooden residence or mercantile building shall be erected within the said provisional fire limits exceeding forty feet in height.

*Amended March 22, 1915 (new ordinance), and new ordinance (paragraph (a)) amended April 26, 1915, as to limits at Stony Island avenue and 95th street, and also the substitution of a new paragraph (m)

*Amended December 30, 1915 [(a)]; also by striking out paragraph (c) and re-lettering the paragraphs following down to and including (n).

Amended paragraph (c 1), June 19, 1916.

719. Nuisance.) (a) Every building or structure constructed or maintained in violation of this chapter, or which is in an unsanitary condition, or in an unsafe or dangerous condition or which in any manner endangers the health or safety of any person or persons, is hereby declared to be a public nuisance.

(b) Every building or part thereof which is in an unsanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water, or by reason of the presence of sewer gas, or by reason of any portion of a building being infected with disease or being unfit for human habitation or which by reason of any other unsanitary condition, is a source of sickness, or which endangers the public health, is hereby declared to be a public nuisance.

720. Penalty.) Any person, or corporation who violates, neglects or refuses to comply with, or who resists or opposes the enforcement of any of the provisions of this chapter, shall be fined not less than twenty-five nor more than two hundred dollars for each offense, and every such person or corporation shall be deemed guilty of a separate offense for every day on which such violation, neglect or refusal shall continue;

and any builder or contractor who shall construct any building in violation of any of the provisions of this chapter, and any architect designed, drawing plans for or having charge of such building or who shall permit it to be constructed, shall be liable to the penalties provided and imposed by this section.

721. No Amusement License to Issue Without Certificate from City Officials.) No license shall be issued to any person, firm or corporation to produce, present, conduct, operate or offer for gain or profit, any theatricals, shows or amusements until the Commissioner of Buildings, the Commissioner of Health, the Fire Marshal and the City Electrician shall have certified in writing that the room or place where it is proposed to produce, present, conduct, operate or offer such theatricals, shows or amusements complies in every respect with the ordinances of the City of Chicago.

722. Lighting—Buildings Kept Lighted During Performance.) Every portion of any building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain or profit devoted to the use or accommodation of the public, and all outlets therefrom leading to the street, including all open courts, corridors, stairways, exits and emergency exit stairways shall be well and properly lighted during every performance, and shall remain lighted until the entire audience has left the premises. It shall be the duty of the Fire Marshal to enforce the provisions of this section.

723. Independent Lighting Systems for Exits.) All stairways and corridors in every building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain, shall be supplied with a supplemental lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building or structure and shall be in operation during the entire period that such building or structure is open to the public and until the entire audience has left the building.

The word "Exit" shall appear in letters at least six inches high over the opening of every means of egress from such building or structure, and a red light shall be kept burning over such sign.

It shall be the duty of the City Electrician to enforce the provisions of this section relative to the installation of the lighting provisions contained therein; and it shall be the duty of the Fire Marshal to see the lights are kept lighted as required by this section.

724. Gas Calcium Lights Prohibited—Arc Lights.) The use of gas calcium lights in any building in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain, is hereby prohibited.

All arc lights used on the stage shall be subject to the approval of the City Electrician.

725. Exit Doors or Gates Not to be Locked—Obstructions Prohibited.) No exit door or gate in any place in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain, shall be locked or fastened in any manner during the entire time that such place of amusement is open to the public.

All aisles, passageways, corridors and exists of all such places of amusement shall be kept free from camp stools, chairs, sofas, draperies and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles, passageways, corridors or exits during any performance.

726. **Diagram of Exits and Seats.** It shall be the duty of the owner, lessee or manager of any theater having a seating capacity in excess of 300 persons, to cause to be printed on all programs furnished for any performance, on the page opposite to that upon which the cast is printed, a diagram showing conspicuously the place of every exit from such building. A diagram of the floor plan showing the location of every seat on each floor, and also the exits leading from each floor, drawn to a scale of one-eighth of an inch to the foot, shall be posted in a conspicuous place in the box office of any such theater, so as to be easily seen by the public. It shall be the duty of the Fire Marshal to enforce the provisions of this section.

727. Any person, firm or corporation violating any of the provisions of this ordinance shall be fined not more than two hundred dollars for each offense, and each and every day upon which any such person, firm or corporation shall give, conduct, produce, present, offer or operate any such entertainment contrary to or in violation of any of the provisions of this ordinance shall constitute a separate and distinct offense.

ORDINANCE CONCERNING GARAGES.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 1 of an ordinance relating to garages, passed by the City Council on July 17, 1911, as published in the righthand column of page 962 of the Journal of the Proceedings of the City Council of the City of Chicago for the years 1911 and 1912, be and the same is hereby amended so as to read as follows:

Section 1. No person, firm or corporation shall keep, conduct or operate a garage in this city without first obtaining a license so to do in the manner hereinafter provided, and it shall not be lawful for any person, firm or corporation to locate, build, construct or maintain any garage within two hundred feet of any building used as and for a hospital, church, or public or parochial school or the grounds thereof, nor shall any person, firm or corporation locate, build, construct or maintain any garage in the city on any lot in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, or within one hundred feet of any such street in any such block, without the written consent of a majority of the property owners according to frontage on both sides of the street; *provided, that all lots which abut only on a public alley or court shall be considered as fronting on the street to which such alley or court leads.*

Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction of any such building; provided, that in determining whether two-thirds of the buildings on both sides of such street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered; only that part of the street in question which lies between the two nearest intersecting streets.

Section 2. Any person desiring to keep, conduct or operate a garage shall make application to the Mayor on a form to be provided by the City Collector. Such application shall set forth the name of the applicant, and, if an individual or individuals, the place of his or their residence, and, if a corporation, the names of the officers and their places of residence. Such application shall also contain the location of the place

at which it is intended to keep such garage and the number of vehicles to be kept in such garage for the purpose of letting for hire or reward, together with a description of the style or type thereof. The Mayor shall thereupon issue or cause to be issued a license upon the payment by such applicant to the City Collector of a license fee in accordance with the rates hereinafter fixed.

Section 3. For all garages where vehicles are kept ready for use and where rent is paid to the keeper thereof for such keeping, or where vehicles are kept to be let out for hire or reward, or where vehicles are kept ready for use and where rent is paid to the keeper thereof and where vehicles are kept to be let out for hire or reward, the license fee shall be twenty-five dollars per annum.

Section 4. All such licenses shall expire on the thirty-first day of December following the date of issue, and, when issued for a period of more than six months, the license fee shall be the full annual license fee prescribed in the foregoing section. When issued for a period of less than six months, the license fee shall be one-half of the annual fee prescribed in the foregoing section.

If such garage keeper shall at any time, before the expiration of any license issued to him under the provisions of this article, change his place of business, he shall forthwith give notice of such fact to the City Collector.

Section 5. Any person violating any of the provisions of this ordinance, shall be fined not less than five dollars nor more than one hundred dollars for each offense, and his license shall be subject to revocation by the Mayor.

Section 6. That Sections 2684 and 2685 of The Chicago Code of 1911, adopted March 13, 1911, and all ordinances and parts of ordinances conflicting with this ordinance be and the same are hereby repealed.

Section 7. This ordinance shall take effect from and after its passage and due publication.

Passed July 17, 1911.

Section 1 amended December 7, 1914.

AN ORDINANCE

Declaring theatres located above the first floor of buildings nuisances.

Be it ordained by the City Council of the City of Chicago:

Section 1. That it shall be and it is hereby declared to be a nuisance to conduct a public theatre in a room located on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordinances of the City of Chicago with reference to fireproof construction in force at the time such building was built, and that all such public theatres now being conducted in rooms on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordinances of the City of Chicago with reference to fireproof construction in force at the time such building was built, with a seating capacity of more than three hundred, shall be and they are hereby declared to be nuisances; and it shall be unlawful to continue to use such rooms for public theatrical purposes whether the same are equipped with a stage and scenery or are used for moving picture shows only.

The provisions of the foregoing paragraph shall not apply where the theatre is altered so as to bring the main audience room on the first floor level and slow-burning con-

struction is used in the reconstruction work and in making such alterations and all requirements of the ordinances of the City applying to Class IVb are complied with, nor shall said provisions apply where the following conditions are fully complied with:

(a) The building shall be used for theatre purposes only.

(b) The seating capacity shall not exceed the seating capacity at the time of passage of this ordinance.

(c) Metal scenery only shall be used; provided, however, one proscenium drop, one back drop and three borders may be used provided they are of asbestos cloth subject to the approval of the Fire Marshal.

(d) All seats shall be at least eighteen inches wide and spaced thirty-two inches from back to back.

(e) There shall be no boxes, stalls or loges.

(f) No stove or furnace heating shall be allowed.

(g) All lighting shall be by electricity; provided, however, that gas may be used in connection with exit lights.

(h) At least sixty inches of exit space shall be provided for every one hundred seats.

(i) The stage shall not be more than twenty-two feet from front to rear.

(j) The audience room shall be surrounded by brick walls.

(k) In all cases where dressing rooms are placed back of the stage the brick wall shall extend between the stage and such dressing rooms, but the stage wall may contain a door leading to such dressing room located behind said wall.

(l) All dressing rooms shall have incombustible partitions and all existing wooden partitions, wherever located, shall be removed.

(m) There shall be an open space on at least three sides of the building containing such theatre, except as otherwise herein provided, which space shall be open from the floor level of the auditorium to the sky.

(n) One of such open spaces must be a public street and the others public or private alleys or open spaces leading directly to a street or public or private alley, and in all cases where such open space is private ground, it must be at least five feet wide where the seating capacity does not exceed six hundred, and six inches additional width must be provided for each one hundred seats installed in such theatre in excess of six hundred; provided, however, that in all cases where a sprinkler system is installed over the stage, together with an approved power pump and pressure tank subject to the approval of the Fire Marshal, it shall be sufficient if there are open spaces as above required on two sides of the building in which such theatre is located.

(o) Wherever the side of an audience room adjoins an open space, as hereinabove required, which open space is on private ground or is a private or public alley, there shall be a five-foot open iron platform extending the entire length of the audience room, with an open iron stairway leading to the ground from said platform at each end thereof, and in all such cases there shall be a stairway fire escape leading from the gallery of the theatre, if there is a gallery, to such platform.

(p) When the only open space adjoining the side of the audience room is a public street, there shall be a five-foot stairway, enclosed by walls of incombustible material, leading from the middle of

the audience room on the side contiguous to such street to the first floor, at the bottom of which stairway there shall be an exit opening directly to the street, and in such cases there shall be a three-foot stairway leading from the gallery, if there is a gallery, to the main floor of the auditorium, the bottom of which shall be within ten feet of the stairway leading from such main floor to the ground floor.

(q) There shall be an exit at least five feet wide on each side of the stage, which exit shall lead through a passageway constructed entirely of incombustible material to a stairway which shall be completely enclosed with incombustible material. Said stairway shall lead to the ground level and communicate through a passageway of incombustible material directly with a public street or alley or a private alley which leads directly to a public street or alley.

(r) An exit shall be provided on each side of the balcony or gallery at the end nearest the stage by means of a stairway of incombustible material leading to the main floor of the audience room.

(s) The exits at the front of the theatre shall communicate with stairways of incombustible material leading directly to the ground level and either opening directly out upon the street or communicating with the street through fireproof passageways, and in no case shall any stairway leading from the main audience floor to the ground level communicate or connect with any other such stairway.

(t) All doors leading through the proscenium wall or from the stage to the dressing rooms shall be of incombustible material.

(u) All alterations made in buildings containing such theatres shall be of slow-burning construction, except as herein otherwise provided.

Section 2. Any person, firm or corporation that shall violate any of the provisions of this ordinance shall be fined not less than twenty-five (\$25.00) dollars nor more than two hundred (\$200.00) dollars for each offense, and each day's operation contrary to this ordinance shall be considered a distinct and separate offense.

Section 3. This ordinance shall take effect and be in force from and after its passage and due publication.

Passed July 22, 1912.

ORDINANCE LIMITING LOCATION OF HOSPITALS.

Be it ordained by the City Council of the City of Chicago:

SECTION 1. That Section 1220 of The Chicago Code of 1911 be and the same is hereby amended so as to read as follows:

"1220. (Location of Hospital near School or Playground.) No hospital of any kind or description shall hereafter be erected or established within four hundred feet of any property used for public or parochial school purposes or as a public playground."

SECTION 2. This ordinance shall take effect and be in force on and after its passage and due publication.

Passed April 29, 1912.

AN ORDINANCE.

Ice-making Houses—Location.

Be it ordained by the City Council of the City of Chicago:

SECTION 1. That Article II of Chapter LXXI of The Chicago Code of 1911, be and the same is hereby amended by inserting therein a new section to be known as "2414½", after Section 2414 and before Section 2415, as follows:

"2414½. **Location of Ice Making Houses and Cooling Plants.**) It shall be unlawful for any person, firm or corporation to locate, establish, conduct or maintain any ice making house or cooling plant within four hundred (400) feet of any church, hospital, public or parochial school, said distance to be measured by the shortest straight line between the ice making house or cooling plant sought to be so located, established, conducted or maintained, and any such building used for the purpose of a church, hospital, public or parochial school."

Section 2. This ordinance shall take effect and be in force from and after its passage and due publication.

Ordinance passed December 30, 1912.

Ice-making Houses—Frontage Consents.

Be it ordained by the City Council of the City of Chicago:

Section 1. It shall be unlawful for any person, firm or corporation to locate, establish, conduct or maintain any ice making house or cooling plant in any block in which two-thirds of the buildings fronting on both sides of the street on which the proposed plant shall be located are devoted exclusively to residence purposes unless the owners of the majority of the frontage in said block on both sides of the street on which said plant is located shall consent in writing to the location, establishment, conducting or maintenance of such plant in such block, such written consents of the majority of said property owners shall be filed with the Commissioner of Buildings before a permit shall be granted for the building or constructing of any such ice making house or cooling plant.

Section 2. Any person, firm or corporation violating any of the provisions of this article, or refusing, failing or neglecting to comply with any of the said provisions, shall be fined not less than \$5.00 nor more than \$100.00 for each offense, and a separate offense shall be regarded as having been committed for each day during which such violation shall continue.

Section 3. This ordinance shall take effect and be in force from and after its passage and due publication.

Ordinance passed January 3, 1913.

Buildings, Etc., in Streets.

Be it ordained by the City Council of the City of Chicago:

Section 1. That The Chicago Code of 1911 be and the same is hereby amended by inserting after Section 2444 thereof three (3) sections numbered respectively 2444a, 2444b and 2444c, to read as follows:

2444a. **Erection of Building or Other Structure in Street Forbidden.**) No person or corporation shall erect or place any building or other structure, in whole or in part, upon any street, alley, sidewalk or other public ground within the city, and every person or corporation that violates or fails to comply with any of the provisions of this section shall be fined not less than twenty-five dollars nor more than two hundred dollars.

2444b. **Obstruction Upon Streets—New Street.**) The owner of any building, structure, fence, porch, steps, gallery or other obstruction now standing or which may hereafter be erected or placed upon any street, alley, sidewalk or public ground within this city, or which may be left standing upon any new street that has been opened, or may hereafter be opened, shall remove the same within such reasonable time, not exceeding thirty days, as may be fixed by the Commissioner of Public Works in a written notice to be served

as hereinafter provided for, but the time fixed therein shall not be less than five days after such service. Such written notice may be served upon the owner or upon the person or corporation in possession or occupancy of the premises, or by posting the written notice upon such building, structure, fence, porch, steps, gallery or other obstruction.

Any person or corporation violating any of the provisions of this section shall be fined not less than twenty-five dollars nor more than two hundred dollars, and shall be fined a further sum of ten dollars for each and every day such building, structure, fence, porch, steps, gallery or other obstruction shall remain after the expiration of the time fixed for the removal of same in the written notice given as in this section provided.

2444c. Refusal to Remove—Nuisance.)

Whenever the owner of any building, structure, fence, porch, steps, gallery or other obstruction upon any street, alley, sidewalk or public ground in this city, shall refuse or neglect to remove the same, after notice served as prescribed in the preceding section, the same shall be deemed a nuisance, and the Commissioner of Public Works shall cause the same to be removed or taken down, and the expense of such removal or taking down shall be recoverable from the owner in an action of assumpsit, and every person who shall forcibly and unlawfully resist the execution of any order of the Commissioner of Public Works in the premises shall be deemed guilty of disorderly conduct and shall be subject to a penalty of not less than five dollars nor more than two hundred dollars.

Section 2. That an ordinance amending The Chicago Code of 1911 by inserting after Section 2444 three sections numbered 2444a, 2444b and 2444c, passed by the City Council of the City of Chicago on March 9, 1914, and appearing on pages 4355 and 4356 of the Journal of the Proceedings of the City Council of that date be and the same is hereby repealed.

Section 3. This ordinance shall take effect and be in force from and after its passage, approval and publication.

Ordinance passed April 27, 1914.

AN ORDINANCE

Requiring the Installation of Gas Shut-offs.

Be it ordained by the City Council of the City of Chicago:

Section 1. All persons, firms or corporations furnishing or supplying gas for lighting, heating or other purposes through pipes or mains laid in the streets or alleys in the City of Chicago, shall equip with a gas shut-off, at their own expense, every service pipe or lead of three-fourths-inch or larger diameter owned or controlled by them through which gas is furnished or supplied from their mains laid in such streets or alleys to buildings or structures other than those used or intended to be used exclusively for residence purposes and occupied by less than four families. Every gas shut-off shall be so constructed as to operate manually to shut off the flow of gas so that in case of fire or other dangerous conditions, it shall not be necessary for firemen or other persons to enter the building or structure supplied with gas to do so, and every such gas shut-off shall be so constructed as to permit of manual control from above the ground and outside of the building or structure to which gas is supplied by such service pipe or lead. Such gas shut-offs may be located in the streets or alleys, but when so located shall be constructed so as not to interfere with public travel at such places as may be des-

Ignated by the fire marshal of the City of Chicago.

Section 2. That all gas shut-offs required to be installed by this ordinance shall be approved by and installed under the supervision and control of the Chief of Fire Prevention and Public Safety of the City of Chicago, and shall at all times be subject to his supervision and control.

Section 3. Any person, firm or corporation failing to equip any service pipe or lead owned or controlled by him or it with a gas shut-off, as required by this ordinance, on or before July 1, 1915, shall be subject to a fine of not less than five (\$5) dollars nor more than fifty (\$50) dollars for each offense, and such offense shall be considered to exist for failure to comply herewith on each and every day such failure continues.

Section 4. Any person who, without the consent of the owner, shall destroy, meddle or tamper with any gas shut-off or any part thereof, or attachment thereto, which has been approved and installed in compliance with this ordinance, shall be subject to a fine of not less than fifty (\$50) dollars nor more than two hundred (\$200) dollars for each offense.

Section 5. This ordinance shall take effect and be in force from and after its passage, approval and due publication.

Ordinance passed July 2, 1914.

Amended June 28, 1915.

*AN ORDINANCE

To provide for the licensing and regulation of mason contractors and employing masons.

Be it ordained by the City Council of the City of Chicago:

Section 1. Any person, firm or corporation engaged in or desiring to engage in or work at the business of masonry or mason work either as contractor, sub-contractor or employing mason, in the City of Chicago, shall submit to an examination and shall obtain a license as a mason contractor or employing mason in the manner hereinafter provided for; provided, that whenever a firm or corporation consists of more than one master or employing mason, it shall not be necessary for more than one member of said firm or one officer of said corporation to undergo such examination in order to obtain a license for such firm or corporation. The words "masonry" or "mason work" as herein used shall include all work in brick, stone, concrete, terracotta, tile and fireproofing, or any combination of these materials, as used in and about the construction of buildings or structures above or below the surface of the ground, with the exception of laying brick or concrete sidewalks and brick or concrete paving.

Section 2. There is hereby created a board of examiners of mason contractors, consisting of three members, all of whom shall be practical masons, and who shall be appointed by the Mayor, by and with the advice and consent of the City Council, and their term of office shall extend until the first day of May following their appointment, and their successors shall be appointed in like manner for the term of one year annually before the first day of May. *Said board shall select its own chairman.* Each member of said board so appointed shall, before entering upon the duties of his office, execute a bond to the city in the sum of Five Thousand Dollars (\$5,000), with sureties to be approved by the City Council, conditioned for the faithful performance of the duties of the office to which he has been appointed. Each of the members of the said board of examiners of mason contractors shall receive such salary as may be provided therefor in the annual appropriation bill.

Section 3. The secretary to the Board of Examiners of Plumbers shall act as secretary to the said board of examiners of mason contractors. It shall be his duty to preserve and keep all of the records, books and papers, which are required by law to be kept by or filed with the said board of examiners of mason contractors, and to do and perform such other service as may be from time to time required of him by said board.

Section 4. Any person, firm or corporation desiring to procure a license as a mason contractor or employing mason shall make application to the board of examiners of mason contractors and shall, at such time and place as said board may designate, undergo such examination as to qualifications and competency to engage in such business as the said board of examiners may direct. Said examination shall be made in whole or in part in writing and shall be of a practical and elementary character, sufficiently strict, to test the qualifications of the applicant. Where the applicant is a firm or corporation such applicant shall state in writing the name or names of the person or persons connected therewith who will submit to such examination as to qualifications, and in case such firm or corporation receives a license and thereafter severs its connection with such person or persons, so that no member of said firm or office of said corporation has qualified as a mason contractor or employing mason as required by this ordinance, the license granted to such firm or corporation shall no longer be in force, and such firm or corporation shall be required to make a new application for a license in the same manner as before.

Section 5. Said board of examiners of mason contractors shall examine such applicants as to their practical knowledge of masonry and mason construction and all matters pertaining to mason construction and, if satisfied of the competency of any such applicant, shall thereupon issue a license to such applicant, authorizing him to engage in the business of mason contracting or employing mason. The fee for such examination, including the first year's license fee, shall be fifty dollars, and thereafter the annual license fee for such mason contractor or employing mason shall be twenty-five dollars; said license shall be valid and have force for a period of one year from the date of issuance, except as herein otherwise provided, and may be renewed upon its expiration by paying in advance the annual renewal fee. All fees received for said examinations and licenses shall be paid into the city treasury.

Section 6. All mason work placed in or upon or in connection with any building or other structure in the City of Chicago shall be done in accordance with the ordinances regulating materials, construction, alteration and inspection of such work now or hereafter in force in the City of Chicago, and no mason work shall be done upon any building without a permit being first issued therefor by the Commissioner of Buildings. In every case where any mason work forms a part of the work to be done in or about the construction of a building or other structure for which a building permit is required under the ordinances of the city, such permit shall only be issued upon the application of a person, firm or corporation licensed as a mason contractor or employing mason, or upon an application containing a statement that all mason work on such building or other structure will be performed by a licensed mason contractor or employing mason; and in case any masonry or mason work on any such building or other structure shall be performed by any contractor or employing mason not licensed as herein provided, such permit shall be revoked, and the person or persons performing such work and the person or persons having such work

done shall be subject to the penalty herein prescribed.

Section 7. Any person, firm or corporation engaged in the business of contracting for masonry or mason work that shall fail to procure a license as herein provided for, or any person, firm or corporation that shall violate any of the provisions of this ordinance, shall be fined not less than five dollars nor more than fifty dollars for each offense, and in addition to such penalty the license of any person, firm or corporation licensed hereunder may be revoked for cause in the discretion of the Mayor.

Section 8. This ordinance shall take effect and be in force from and after its passage and due publication.

Ordinance passed January 16, 1914.

*Amended November 1, 1915.

Lumber—Storing, Etc.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 309 of an ordinance entitled "An ordinance creating the bureau of fire prevention and public safety," passed by the City Council of the City of Chicago, July 22nd 1912, and subsequently amended, be and the same is hereby further amended so as to read as follows:

"Section 309. It shall be unlawful for any person, firm or corporation to pile, or maintain a pile of, lumber or other materials of like combustible nature within the fire limits of the City of Chicago as the same are now or may hereafter be defined by ordinance, for the purpose of storing, drying or seasoning the same within one hundred feet of any building of class 2 (B), class 2 (C), class 3, class 4, class 5, class 6, class 7 or class 8, as classified in The Chicago Code of 1911, nor within fifty feet of any building of class 1 unless the walls of such building of class 1 shall be of masonry or concrete construction with incumbustible roof and all exposed windows, door and other openings fitted and protected with approved fire resisting wired glass in metal sash and frames or with metal or metal-clad shutters and doors, under which conditions lumber and like combustible material may be piled not closer than twenty-five feet to any such building."

Section 2. That Section 665 of The Chicago Code of 1911, as subsequently amended, be and the same is hereby repealed.

Section 3. This ordinance shall be in force and effect from and after its passage and due publication.

Ordinance passed March 30, 1914.

AN ORDINANCE

Restricting the noise of building operations at night in residential districts.

Be it ordained by the City Council of the City of Chicago:

Section 1. It shall be unlawful for any person, firm or corporation, in conducting any building operations between the hours of ten o'clock in the evening and four o'clock in the morning, to operate or use any pile drivers, steam shovels, pneumatic hammers, derricks, steam or electric hoists or other apparatus, the use of which is attended with loud or unusual noise, in any block in which more than half of the buildings on either side of the street are used exclusively for residence purposes.

Section 2. Any person, firm or corporation violating any of the provisions of Section 1 hereof shall be fined not less than five dollars, nor more than one hundred dollars for each offense, and each day's violation of same shall be considered a separate offense.

Section 3. This ordinance shall take effect and be in force from and after its passage and due publication.

Ordinance passed November 13, 1911.

AN ORDINANCE

Regulating the Sale of Crushed Stone, Bank Sand, Torpedo Sand and Gravel.

Be it ordained by the City Council of the City of Chicago:

Section 1. Any person, firm or corporation engaged in the business of selling crushed stone, bank sand, torpedo sand or gravel within the City of Chicago in wagon load lots, or in amounts less than wagon load lots, for delivery in the said city, shall, in the absence of a contract or agreement in writing to the contrary signed by the parties thereto sell the same by Standard Avordupois Net Weight and in no other way. All such crushed stone, bank sand, torpedo sand and gravel so sold shall be weighed on a scale that has been duly inspected and sealed by the inspector of weights and measures.

In case any such crushed stone, bank sand, torpedo sand or gravel is sold and delivered in wagon load lots, or in amounts less than wagon load lots, a written or printed memorandum showing the date of the weighing, the gross weight, the tare and net weight of such crushed stone, bank sand, torpedo sand or gravel, the name and address of the seller and purchaser thereof, the number of the wagon or other conveyance in which the same is delivered, if such wagon or other conveyance be numbered, and the name of the teamster driving such wagon or person in charge of such other conveyance, shall be delivered to the purchaser by the teamster or person in charge of such wagon or other conveyance, at the time of the delivery of the material, or to the inspector of weights and measures or any of his deputies upon demand of such inspector or deputy.

Whenever the purchaser or intending purchaser, or the inspector of weights and measures or any of his deputies, shall make demand that the weight of the load be verified, it shall thereupon become the duty of the person, firm or corporation delivering such material to convey the same to some Public Scale selected by the inspector of weights and measures of the City of Chicago or any of his deputies, or the purchaser or intending purchaser of the material being delivered, in the particular locality where the material is to be delivered, or to any private scale in the particular locality where the owner thereof shall consent to such use, and permit the weighing of the material together with the equipment, for the purpose of ascertaining the gross weight thereof, and shall, after the delivery of such material, return forthwith with the conveyance and equipment used in the delivery of such material provided, further, that the word "block", as used in this section, shall not be held to mean a square, but shall be held to embrace material to the same scale and permit the weighing of said conveyance and equipment for the purpose of verifying the net weight of the material, as shown by the said memorandum; provided, however, that if such person, firm or corporation so delivering the said material requests the privilege of reweighing said material on another and different scale than that selected by the inspector of weights and measures of the City of Chicago or any of his deputies, or the purchaser or intending purchaser, said inspector of weights and measures or his deputy, or the purchaser or intending purchaser to whom delivery is to be made, shall permit such weighing on some other scale in the particular locality.

Any person, firm or corporation violating any of the provisions of this ordinance, or who shall refuse or neglect to comply with

any of the provisions thereof, shall be fined not less than five dollars nor more than fifty dollars for each offense, and any person, firm or corporation delivering or attempting to deliver crushed stone, bank sand, torpedo sand or gravel within the city of a quantity less than that called for by the delivery memorandum, as hereinbefore provided for, shall be fined not less than twenty-five dollars nor more than one hundred dollars for each offense.

Section 2. This ordinance shall take effect and be in force from and after its passage and due publication.

Ordinance passed October 19, 1911.

Contractors for Buildings—Requiring Registration with Commissioner of Buildings.

Be it ordained by the City Council of the City of Chicago:

Section 1. That every person, firm, company or corporation engaged in the business of constructing or repairing the whole or any part of buildings or the appurtenances thereto in the City of Chicago, shall before undertaking the erection, enlargement, alteration, repair or removal of any building, for which permits are required by the ordinances of the City, register the name and address of such person, firm, company or corporation in a book kept by the Commissioner of Buildings and used for this purpose.

No permit shall be granted to any person, firm, company or corporation for the erection, enlargement, alteration, repair or removal of any building in the City for which a permit is required unless the name and address of the person, firm, company or corporation undertaking the work of construction involved in the erection, enlargement, alteration, repair or removal of such building is contained in the registration book kept by the Commissioner of Buildings.

When application is made for a permit and the work of construction involves masonry construction only the above provisions shall not apply to any person, firm or corporation licensed as a mason contractor or employing mason as provided in and by an ordinance passed by the City Council on January 16, 1911, as amended on March 9, 1911. Where the work of construction for which a permit is sought involves construction other than masonry construc-

tion, any mason contractor or employing mason, licensed as aforesaid, engaged in or undertaking the work of such other construction than masonry construction must register his, their or its name or names and comply with the other requirements of this ordinance as herein provided before a permit as required by the ordinances of the City for such work is issued.

Section 2. If any person, firm, company or corporation whose name is registered in the registration book kept by the Commissioner of Buildings, shall fail in the execution of any work for which a permit was issued as aforesaid to comply with the ordinances of the City relative to the erection, enlargement, alteration, repair or removal of any building, either the Commissioner of Buildings or the Commissioner of Health may, according to the ordinances of the City of Chicago, bring suit and prosecute said person, firm, company or corporation for such failure or violation, and if such person, firm, company or corporation is convicted of any violation of the said ordinances of the City of Chicago, his, their or its name or names shall be stricken from the registration book kept by the Commissioner of Buildings and shall not be re-entered or re-instated during such time as any violation exists or any judgment remains unsatisfied with regard to said conviction.

Section 3. Any person, firm, company or corporation that may have been convicted of violating any of the ordinances relating to the erection, enlargement, alteration, repair or removal of any building that may have had his, their, or its name or names stricken from the registration book kept by the Commissioner of Buildings as aforesaid, may have his, their or its name or names re-entered in said registration book for the purpose of obtaining building permits, on filing with the Commissioner of Buildings certificates from the City Prosecutor, the Commissioner of Buildings and the Commissioner of Health to the effect that all violations upon the premises with reference to which conviction was secured, have been corrected and are non-existent and that all claims and judgments with regard to such conviction have been paid.

Section 4. This ordinance shall be in full force and effect from and after its passage and due publication.

AN ORDINANCE.

Paragraph C of Section 230 Pertaining to Plans.

All plans and drawings for the construction or alteration of any building or other structure for which a building permit is required may, at the option of the applicant for a building permit, and by payment of a fee of one dollar for each plan, be filed in the office of the Commissioner of Buildings, and a receipt or check will be given for said plans which must be presented for the return of same after they have been examined and passed upon. The Commissioner of Buildings shall appoint a clerk with such necessary assistants whose duty it shall be, under the direction of the Commissioner of Buildings, to receive, take charge of and return all plans and drawings filed as aforesaid. Every plan or drawing so filed in the office of the Commissioner of buildings shall be forwarded by him successively to

the Department of Smoke Inspection, the Department of Boiler Inspection, the Department of Public Works, the Bureau of Fire Prevention and Public Safety and the Sanitary Bureau, and there submitted to the proper officials of these respective departments and bureaus for examination and approval, and after said plans have been examined and passed upon, the Commissioner of Buildings shall cause said plans or drawings to be returned to his office where they shall be taken up for examination and approval by the Commissioner of Buildings. At the proper time notice shall be given by the Commissioner of Buildings to the applicant that his plans have been examined and are ready to be returned to him, and if such plans have been approved as submitted by the various departments and bureaus as aforesaid, the Commissioner of Buildings then shall, according to ordinance, issue a permit for the construction or erection of such building or structure.

Special Rulings of the Building Department of the City of Chicago

These rulings are not a part of the Code of the City of Chicago; But are requirements of the Building Department.

BRACING OF TRUSSES, COLUMNS, WALLS, ETC., IN STEEL SKELETON CONSTRUCTION.

I

In regard to Section 569 of the Revised Building Ordinances, the Commissioner has ruled that the following interpretation shall be placed upon the section concerning bracing:

(a) All skeleton buildings, trusses, and structures shall be securely braced during erection by guys, cables or such other temporary supports as may be necessary to provide for stresses due to erection.

(b) Special wind bracing shall be provided in steel skeleton buildings over one hundred (100) feet in height or higher than twice the least width. Whenever it is impossible to avoid rivets being in tension to resist such wind stresses, the same shall be assumed at three-fourths ($\frac{3}{4}$) the resisting value of the rivet in single shear.

(c) For permanent construction bracing shall be of the same material as the structure itself and it shall be so designed that the **skeleton will be self-supporting and safe against lateral and buckling or crippling forces before any of the inclosing walls or roofs are built in place.**

(d) In cases where wind forces are nominal and to prevent buckling or crippling, the minimum amount of bracing required shall be $\frac{3}{4}$ " rod for steel tension members or equivalent in other material. Compression members shall be limited in length to one hundred and fifty (150) times the least radius of gyration or otherwise as specified in the Ordinances.

(e) Trusses shall be properly anchored to the walls at the point of bearing in such a way as not to strain the masonry on account of the temperature stresses in the truss.

(f) In general, all eccentric loading on the foundations shall be avoided and where not possible to do so, proper bracing between opposite walls shall be provided, sufficient to offset the bending moment due to eccentricity.

NOTES ON REINFORCED CONCRETE DESIGN.

II

(a) In regard to Section 550, as applying to a combination of tile and concrete construction, the Commissioner has ruled that the width of flange of the concrete joists may be assumed as the full distance c. to c. of ribs but not exceeding eight (8) times the thickness of the concrete on top of tile fillers, plus the average width of rib.

(b) In computing the shear at supports, the average width of the concrete rib plus the thickness of the tile on one side of the rib may be figured as the effective width of joist, provided that joints in tile are properly staggered.

(c) When steel or plaster fillers are used between concrete joists, the width of flange shall be limited to three-fourths ($\frac{3}{4}$) of the distance center to center of ribs as per Section 550.

In regard to Section 547 (c)

(a) When compression is applied to a surface of concrete of at least twice the loaded area, a stress of thirty (30) per cent of the ultimate may be allowed, and

(b) In continuous beams and girders the compressive stress in extreme fibre at the support may be fifteen (15) per cent greater than at the center of span.

In regard to Section 549 (1)

The total amount of steel required for square slabs with two-way reinforcement may be reduced twenty (20) per cent by gradually increasing the rod spacing from the third point to the edge of the slab.

THE DESIGN OF FLAT SLABS SHALL BE IN ACCORDANCE WITH THE FOLLOWING RULING.

III

Definitions.

Flat slabs as understood by this ruling are reinforced concrete slabs supported directly on reinforced columns with or without plates or capitals at the top, the whole construction being hingeless and monolithic without any visible beams or girders. The construction may be such as to admit the use of hollow panels in the ceiling or smooth ceiling with depressed panels in the floor.

The column capital shall be defined as the gradual flaring out of the top of the column without any marked offset.

The drop panel shall be defined as a square or rectangular depression around the column capital extending below the slab adjacent to it.

The panel length shall be defined as the distance center to center of columns of the side of a square panel, or the average distance center to center of columns of the long and short sides of a rectangular panel.

Columns.

The least dimension of any concrete column shall be not less than one-twelfth (1/12) the panel length, or one-twelfth (1/12) the clear height of the column.

Slab Thickness.

The minimum total thickness of the slab in inches shall be determined by the formula:—

$$t = .023 L \sqrt{w} =$$

.023 L times the square root of "w".

In the formula hereinabove given

"L"=total thickness of slab in inches.

"L"=panel length in feet.

"w"=total live and dead load in lbs. per square foot.

In no case shall the slab thickness be less than one-thirty-secondth (1/32) of the panel length for floors, and one-fortieth (1/40) of the panel length for the roofs, and also not less than six inches (6").

Column Capital.

The diameter of the column capital shall be measured where its vertical thickness is at least one and one-half inches (1½"), and shall be at least two hundred and twenty-five thousandths (.225) of the panel length.

The slope of the column capital shall nowhere make an angle with the vertical of more than forty-five degrees. Special attention shall be given to the design of the column capital in considering eccentric loads, and the effect of wind upon the structure.

Drop Panel.

The depth of the drop panel shall be determined by computing it as a beam, using the negative bending moment specified elsewhere in this ruling. The width and length shall be determined by the allowable unit

shearing stresses on the perimeter, given below.

Shearing Stresses.

The allowable unit punching shear on the perimeter of the column capital shall be three-fiftieths (3/50) of the ultimate compressive strength of the concrete as given in section 546 of the building ordinance. The allowable unit shear on the perimeter of the drop panel shall be three one-hundredths (3/100) of the ultimate compressive strength of the concrete. In computing shearing stress for the purpose of determining the resistance to diagonal tension the method specified by the ordinance shall be used.

Panel Strips.

For the purpose of establishing the bending moments and the resisting moments of a square panel, the panel shall be divided into strips known as strip A and strip B. Strip A shall include the reinforcement and slab in a width extending from the center line of the columns for a distance each side of this center line equal to one-quarter ($1/4$) of the panel length. Strip B shall include the reinforcement and slab in the half width remaining in the center of the panel. At right angles to these strips, the panel shall be divided into similar strips A and B, having the same widths and relations to the center line of the columns as the above strips. These strips shall be for designing purposes only, and are not intended as the boundary lines of any bands of steel used.

These strips shall apply to the system of reinforcement in which the reinforcing bars are placed parallel and at right angles to the center line of the columns, hereinafter known as the two-way system, and also to the system of reinforcement in which the reinforcing bars are placed parallel, at right angles to and diagonal to the center line of the columns hereinafter known as the four-way system.

Bending Moment Coefficients, Interior Panel, Two-Way System.

The negative bending moment taken at a cross-section of each strip A at the edge of a column capital or over it, shall be taken as $WL^2/15$. The positive bending moment taken at a cross-section of each strip A, midway between column centers shall be taken as $WL^2/30$. The positive bending moment taken at cross-section of each strip B in the middle of the panel shall be taken at $WL^2/60$. The negative bending moment taken at a cross-section of each strip B on the center line of the columns shall be taken at $WL^2/60$. In the formulas hereinabove given

"W" total live and dead load per lineal foot of each strip,

"L" panel length in feet.

Bending Moment Coefficients, Interior Panel, Four-Way System.

The negative bending moment taken at a cross-section of each strip A at the edge of the column capital or over it, shall be taken as $WL^2/15$. The positive bending moment taken at a cross-section of each strip A, midway between column centers shall be taken as $WL^2/40$. The positive bending moment taken at a cross-section of each strip B in the middle of the panel shall be taken at $WL^2/60$. The negative bending moment taken at a cross-section of each strip B

on the center line of the columns shall be taken at $WL^2/60$.

Bending Moment Coefficients, Wall Panels.

Wherever the coefficients 1/15, 1/30, 1/40 or 1/60 appear in the moments given for interior panels in either the two-way or the four-way systems, the coefficients 1/12, 1/25, 1/33 and 1/50 respectively shall be used in the moments for wall panels supported on concrete columns and girders.

When brick walls are used partly to support wall panels, these walls shall be stiffened by pilasters or piers as directed by the Commissioner of Buildings. Wherever the coefficients 1/15, 1/30, 1/40 or 1/60 appear in the moments given for interior panels in either the two-way or the four-way systems, the coefficients 1/10, 1/20, 1/27 and 1/40 respectively shall be used in the moments for such panels resting on brick walls.

Point of Inflection.

For the purpose of making the calculations of the bending moment at the sections away from the column capital, the point of inflection shall be considered as being one-quarter ($1/4$) the distance center to center of columns, both cross-wise and diagonally, from the center of the column.

Tensile Stress in Steel and Compressive Stress in Concrete.

The tensile stress in steel and the compressive stress in the concrete to resist the bending moment shall be calculated on the basis of the reinforcement and slab in the width included in a given strip, and according to the assumptions and requirements given in sections 545 to 548 inclusive of the building ordinance.

The steel shall be considered as being concentrated at the center of gravity of all the bands of steel in a given strip.

For the four-way system of reinforcement the amount of steel to resist the negative bending moment over the support in each strip A shall be taken as the sum of the areas of steel in one cross band and one diagonal band. The amount of steel to resist the positive bending moment of each strip B shall be considered as the area of the steel in a diagonal band. The amount of steel to resist the positive bending moment in each strip A shall be considered as the area of the steel in a cross-band, and the amount of steel to resist the negative moment in each strip B shall be the steel included in the width of strip B.

For the two-way system of reinforcement the amount of steel to resist the bending moment in any strip shall be considered as the area of steel included in the width of the strip.

In both systems of reinforcement the compressive stress in the concrete in any strip shall be calculated by taking the area of steel considered for each strip, and applying it in a beam formula based on the principles of section 548 of the building ordinance.

Rectangular Panels.

When the length of a panel does not exceed the breadth by more than five per cent (5%), all computations shall be made on the basis of a square with sides equal to the mean of the length and breadth. In no rectangular

panel shall the length exceed four-thirds ($\frac{4}{3}$) the breadth.

For panels with length more than five per cent (5%) in excess of the breadth, the slab shall first be designed for a bending moment based on an assumed square panel with sides equal to the mean of the length and breadth of the rectangular panel.

For the four-way system of reinforcement the amount of steel found for the positive moment of each strip B by designing in this manner shall be that used in the diagonal band. For the positive moment in each strip A, the required amount of steel in the crossband shall be obtained by multiplying the steel used in the design of the assumed square panel by the cube of the ratio found by dividing the length or breadth of the rectangular panel by the side of the assumed square panel, for the long and short sides of the panel respectively. The compressive stresses shall be calculated on the basis of a width equal to one-half ($\frac{1}{2}$) of the side of the assumed square panel, and on the assumptions used in the calculations of compressive stresses in square panels. In no case shall the amount of steel in the short side be less than two-thirds ($\frac{2}{3}$) of that required for the long side.

For the two-way system of reinforcement, the amount of steel found for the positive and negative moment of each strip B by designing in this manner shall be obtained by multiplying the steel used in the design of the assumed square panel by the cube of the ratio found by dividing the length or breadth of the rectangular panel by the side of the assumed square panel, for the short and long side of the panel respectively. The method of obtaining the amount of steel required for each strip A, shall be the same as that given above for the four-way system.

Walls and Openings.

Girders or beams shall be constructed under walls, and around openings, and to carry concentrated loads.

Computations.

Complete computations of interior and wall panels and such other portions of the building as may be required by the Commissioner of Buildings shall be left in the office of the Commissioner of Buildings when plans are presented for approval.

Placing of Steel.

In order that the slab bars shall be maintained in the position shown in the design during the work of pouring the slab, spacers and supports shall be provided satisfactory to the Commissioner of Buildings. All bars shall be secured in place at intersections by wire or other metal fastenings. In no case shall the spacing of the bars exceed nine inches (9"). The steel to resist the negative moment in each strip B shall extend one-quarter ($\frac{1}{4}$) of the panel length beyond the center line of the columns in both directions.

All splices in bars shall be made over the column head. The length of the splice beyond the center line of the column in both directions shall be at least two feet (2'), nor less than that necessary for the full development of the strength of the bar as limited by the unit bond stresses given by the ordinance. The splicing of adjacent bars shall be avoided as far as possible.

Slab bars which are lapped over the column, the sectional area of both being included in the calculations for negative moment, shall extend not less than twenty-five one-hundredths (.25) of the panel length for

cross-bands, and thirty-five one-hundredths (.35) of the panel length for diagonal bands, beyond the column center.

Test of Workmanship.

The Commissioner of Buildings or his representative may choose any two adjacent panels in the building for the purpose of ascertaining the character of workmanship. The test shall not be made sooner than the time required for the cement to set thoroughly, nor less than six weeks after the concrete had been poured.

All deflections under test load shall be taken at the center of the slab, and shall be measured from the normal unloaded position of the slab. The two panels selected shall be uniformly loaded over their entire area with a load equal to the dead load plus twice the live load thus obtaining twice the total design load. The load shall remain in place not less than twenty-four (24) hours. If the total deflection in the center of the panel under the test load does not exceed one eight-hundredth ($\frac{1}{800}$) of the panel length, the slab may be placarded to carry the full design live load. If it exceeds this amount of deflection, and recovers not less than eighty per cent (80%) of the total deflection within seven days after the load is removed, the slab may be placarded to carry the full design live load. If the deflection exceeds the allowable amount above specified, and the recovery is less than eighty per cent (80%) in seven days after the removal of the test load, other tests shall be made on the same or other panels, the results of which will determine the amount of live load the slabs will be permitted to carry.

General.

The design and execution of the work shall conform to the provisions of the Chicago building ordinances, and to correct principles of construction.

FIREPROOFING OF REINFORCED CONCRETE COLUMNS.

IV

In reference to Section 519-j and Section 564 of the Chicago Building Ordinance, the Commissioner has ruled that in buildings classed as ordinary construction the full section of the column may be calculated in columns reinforced with vertical rods only. In buildings classed as slow burning or mill construction, the outside one and one-half inches shall not be figured in columns reinforced with vertical rods only, and in buildings classed as fireproof construction the outside two inches shall not be figured in the strength of columns with vertical rods only. When spiral reinforcement is used, only the area within the core shall be figured in accordance with Section 552-b.

CAISSONS.

V

Ruling. The Commissioner has ruled that in determining the area required for concrete caissons, the load on the caissons shall be the load for which the basement column was designed, and the allowable stress on the concrete shall be as given in Section 533 (a). The allowable stress used shall be the stress at the top of the caisson.

A RULING ON COUNTERBALANCE OF STAIRWAY FIRE ESCAPES.

VI

The Commissioner of Buildings has made a ruling in regard to the construction of the

movable part of stairway fire escapes as follows:

All counterbalance stairway fire escapes hereafter constructed shall conform to the following requirements in addition to those specified in the Building Ordinance for fixed stairway fire escapes, Section 670.

(a) The stringer carrying the counterweight may be built of steel channels, angles or "I" beams or any combination thereof, not less than eight inches deep and $\frac{3}{8}$ " metal, but it shall be so designed that the maximum fibre stress over the support shall not exceed 8,000 pounds per square inch and the moment of inertia about the vertical axis parallel to the web of the stringer shall not be less than 33% of the moment of inertia about the horizontal axis perpendicular to the web and passing through the center, which shall be accomplished by riveting an angle or angles onto the channel or "I" beam stringer.

(b) The same section of stringer shall be continued for equal distances on either side of the support and the reinforcement shall be extended as close to the counterweight as practicable.

(c) The truss rod from the counterweight to the opposite end of the stringer shall always be used either as an independent brace or in connection with the railing to prevent any sag of the stringer and shall be at least $\frac{3}{4}$ " in diameter firmly connected, the strength of connection to be sufficient to develop the strength of the rod, but in figuring stresses, the stringer must be assumed to carry the total dead and live load as required by the ordinance.

(d) The connection between the stringer and the supporting rod must be designed to stiffen the stringer securely against horizontal or twisting motion by means of a steel casting or forging riveted to the stringer both through the web and the flange.

(e) In order to secure good bearing against the wall under the bracket supporting the platform, the square bracket rods shall be turned up about two inches to a flat bearing before entering the wall, the said two inches to bear snugly against the wall.

(f) All shutters of any description must be removed from all windows and exits to fire escapes hereafter erected.

RULING GOVERNING THE MINIMUM THICKNESS OF METALS.

In steel construction exposed to the weather, no metal in principal members shall be less than 5-16 inch thick. For secondary members, no metal shall be less than 1-4 inch thick, except that webs of channels or "I" beams used as secondary members may be 3-16 inch thick, but not less. This ruling does not apply to electric signs or fire escapes or canopies.

ILLUMINATED AND OTHER ROOF SIGNS OF STEEL SKELETON CONSTRUCTION.

VII

In regard to Section 710, of revised Building Ordinances, the Commissioner has ruled that all illuminated roof signs of steel construction shall conform to the following specific requirements:

(a) All compression members shall be proportioned by the usual formula, $16,000-70l$ except that the length of the main or principal members R may be increased to one hundred and seventy-five (175) times the least radius of gyration, and the length of all secondary or sub-members may be increased to two hundred (200) times the same.

(b) The anchorage of every roof sign shall be designed with a factor of safety not less than two (2), i. e., there shall be at least twice as much weight of masonry or concrete resisting the pull on the anchors as figured from the overturning effect of wind.

(c) The thickness of all structural steel members shall not be less than one-fourth ($\frac{1}{4}$) of an inch.

(d) Where a sign structure is so designed as to allow free access to the roof from all sides of the building and where the minimum clearance between roof and the lower edge of the sign is five (5) feet the sign may be erected directly over and flush with the face of the wall on the street or alley side of the building, provided that no part projects over the coping or the lot line, and the lower edge of the sign is at least five (5) feet above the top of the wall.

Chicago, March 15th, 1916.

With reference to Section 530 (h) of the Revised Building Ordinances, the Commissioner has ruled that,

(a) Whenever two or more rows of piles are required, the distance between the center lines shall not be less than the largest diameter of the piles.

(b) When a single staggered row of piles is used, the distance between the center lines shall not be less than one-half the largest diameter of the piles, except that in one-story buildings or walls less than twenty feet high a single row without any staggering may be used.

(c) The piles shall be driven so that the distance between centers shall not be less than twice the largest diameter nor two feet six inches minimum.

In steel construction protected by buildings no metal in a principal member shall be less than 1-1 inch thick, except that closed sections filled with concrete and the webs of channels and "I" beams may be 3-16 inch thick, but not less. For secondary members metal may be 3-16 inch, but not less.

The above rulings to take effect August 28, 1916.

Illinois Society of Architects

The following is partial list of the publications of the Society, further information regarding same may be obtained from the Financial Secretary, Suite 1211, 19 S. La Salle Street.

FORM NO. 21, "INVITATION TO BID"—Letter size, 8½x11 in., two-page document, in packages of fifty at 75c, broken packages, two for 5c.

FORM NO. 22, "PROPOSAL"—Letter size, 8½x11 in., two-page documents, in packages of fifty, at 75c, broken packages, two for 5c.

FORM NO. 23, "ARTICLES OF AGREEMENT"—Letter size, 8½x11 in., two-page document, in packages of fifty, at 75c, broken packages, two for 5c.

FORM NO. 24, "BOND"—Legal size, 8x13 in., one-page document, put up in packages of twenty-five, at 25c per package, broken packages, three for 5c.

FORM NO. 25, "GENERAL CONDITIONS OF THE CONTRACT"—Intended to be bound at the side with the specifications, letter size, 8½x11 in., ten-page document, put up in packages of fifty at \$2.50, broken packages, three for 25c.

FORM NO. 25, "GENERAL CONDITIONS OF THE CONTRACT"—Intended to be bound at the top with the specifications, legal size, 8x13 in., or standard size, 9x12 in., for binding at side, eight-page document put up in packages of fifty, at \$2.50, broken packages, three for 25c.

FORM NO. 25, "GENERAL CONDITIONS OF THE CONTRACT"—(Fine print, six point bold type). Intended to be bound at the top with the specifications, legal size, 8x13 in., five-page document, three leaves, two printed both sides, 1st page printed one side, put up in packages of fifty, at \$1.75 per package, broken packages, 5c each.

FORM 26, CONTRACT BETWEEN ARCHITECT AND OWNER. Price, two for 5c, in packages of fifty, 75c.

THE ANNUAL—A handbook containing useful information for Architects and Builders and the building code of the City of Chicago, distributed free to Architects licensed to practice in Illinois. Price to others, cloth binding, \$1.50; leather binding, \$2.00.

FORM 1, BLANK CERTIFICATE BOOKS—Either stub or carbon copy, form 4x6 in., 100 blanks, price, 50c.

FORM 4, CONTRACT BETWEEN THE OWNER AND CONTRACTOR—(Old Form.) Price, two for 5c, five for 10c, put up in packages of 50 for \$1.00.

FORM E, CONTRACTOR'S LONG FORM STATEMENT—As required by lien law. Price, two for 5c, five for 10c.

FORM 13, CONTRACTOR'S SHORT FORM STATEMENT—Price, 1c each.

CODES OF PRACTICE AND SCHEDULE OF CHARGES—In mailing envelopes, 4x6 in. Price, 5c each.

These documents may be secured at the Financial Secretary's office, suite 1211, 19 S. La Salle St., telephone Cent. 4214. We have no delivery service. The prices quoted above are about the cost of production. An extra charge will be made for mailing or expressing same. Terms strictly cash, in advance, with the order; except that members of the Society may have same charged to their account.

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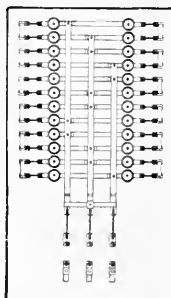
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DEPARTMENT OF ELECTRICITY.

CITY OF CHICAGO.

NOTICE.

Particular attention is called to the different sections of the ordinance herein printed. Permits will be issued only to Registered Electricians.

The use of electric current is prohibited previous to certificate or current permit being issued.

Conditions unsafe to life or property must be corrected within forty-eight hours.

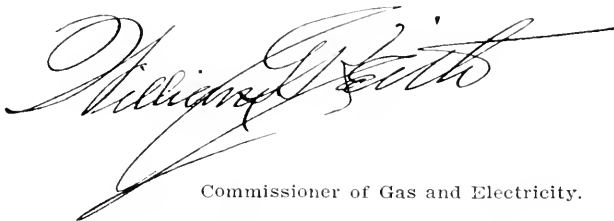
Each building into which electric current shall hereafter be introduced shall have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed in conduits complying with the rules of the department of gas and electricity; and no wires hereafter put up shall pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used.

Temporary work must be inspected and approved before current is used.

Alterations to existing wiring must not be made without regular permit.

Permits issued by the Commissioner of Public Works for electrical work to be done on streets must be countersigned by the Commissioner of Gas and Electricity.

Violation of any of the Sections of this ordinance constitutes a misdemeanor and renders any person, firm or corporation liable to arrest and fine of not less than \$50 or more than \$100, also the cutting off and stopping of current used in violation until the provisions are complied with.



Commissioner of Gas and Electricity.

SPECIAL SUGGESTIONS TO ARCHITECTS.

The Department of Electricity will **not allow more than sixteen (16) sockets to be attached to one circuit.**

Architects are urged to make definite specifications for electrical work, for the benefit of both the electrical contractor and the fixture contractor, specifying the number of outlets in each job for the electrical contractor to follow, and the exact number of 16-candlepower lamps to be used.

Frequently the fixture contractor installs more than sixteen lights on a circuit, which is in violation of the city ordinances, and causes the consumer very much annoyance in getting electric current to his premises.

It is also suggested that the architects demand of the electrical contractor that he make up all connections and combinations relative to switches, complicated outlets, etc., leaving only two wires for the fixture hanger to make his fixture connections.

GENERAL SUGGESTIONS.

In all electric work conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a grounding or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to the minimum.

In all wiring special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors and securing and attaching of fittings, are especially conducive to security and efficiency, and will be strongly insisted on.

In laying out an installation, except for constant current systems, every reasonable effort should be made to secure distribution centers located in easily accessible places, at which points the cutouts and switches

controlling the several branch circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the branches, and all complicated and unnecessary wiring avoided.

SPECIAL NOTICE.

Service switches, cutouts and meters must, when practicable, be placed in basements or other public portions of the building. Exception will be made for cutouts in the case of apartment buildings having 4 circuits or more per apartment or where the building is four stories or more in height. Where cutouts are located in apartments or on the various floors of residences, etc., they must never be located in clothes closets or any other location where combustible material is stored.

Service switches, cutouts and meters should not be installed above or in close proximity to laundry tubs, sinks, gas meters or plumbing fixtures.

Meter outlet fittings must be of approved construction.

A separate fitting is required for each meter.

Meter fittings are required on all installations where the mains are of No. 2 B. & S. gauge or smaller. This includes both power and light.

On mains larger than No. 2 B. & S. gauge, conduit fittings, where wires leave the conduit system through separate insulated openings, must be used.

The meter fitting must be placed so that the opening for the wires is at the top of the fitting, except where the fitting is so constructed that the wires to meter leave at the side.

All wires from fitting to meters where liable to come in contact with wires or other materials must be protected by flexible tubing.

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Sections of the Chicago Code of 1911 of the City of Chicago

Governing Electrical Inspections

Passed March 13, 1911.

Amended December 30, 1912; July 7, 1913; July 21, 1913; November 3, 1913.

CHAPTER XXIV.

ELECTRICITY—ARTICLE 1.

DEPT. OF GAS AND ELECTRICITY.

830. Electric Current.) No electric current shall be used for lighting, heating or power purposes except as hereinafter provided.

831. Applications—Contents—Permit.) All persons or corporations desiring to install wires or other apparatus for the use of electric currents for any of the purposes mentioned in the foregoing section, shall before commencing or doing any electrical construction work of any kind whatever, either installing new electrical apparatus or repairing apparatus already in use, file an application for a permit therefor in the office of the Commissioner of Gas and Electricity, which application shall describe in detail such material and apparatus as it is desired to use, with a full description of the same, giving the locality by street and number, and countersigned by the person under whose supervision the work is to be done; and upon the filing of which application, if found proper, such permit shall be given. No such work shall be done unless under the supervision of a duly qualified person as provided in Section 831½.

831½. Requirements for Registration of Applicant for Permit.) Any person or corporation making application for permits must file with the Commissioner of Gas and Electricity an affidavit stating that the work to be done under such permits will be under the supervision of a person who is not less than twenty-one (21) years of age, who has a thorough knowledge of electrical construction, and who has had not less than four (4) years of practical experience in the installing of electrical wires and apparatus for the purposes mentioned in the foregoing section. Such affidavit must contain the name and signature of the person under whose supervision the work is to be done, together with two indorsements from responsible citizens, made under oath, that such person possesses the qualifications above mentioned. Upon the filing of such affidavit, if found proper, and upon the payment of a fee of twenty-five (\$25.00) dollars to the City Collector, the Commissioner of Gas and Electricity shall issue a certificate of registration to such applicant, which shall entitle him to obtain permits to install electrical wires and apparatus as aforesaid for a period of one (1) year, provided that the fee to be paid to the City Collector, for a renewal of said certificate of registration, shall be ten (\$10.00) dollars per year.

832. Duties of Commissioner of Gas and Electricity Thereon.) The said Commissioner of Gas and Electricity or his assistants shall have power, and it shall be their duty, when deemed necessary by the Commissioner of Gas and Electricity, to carefully inspect any such installation previous to and after its completion, and they shall have the right to enter any building when by them deemed necessary, to inspect any such installation,

and it shall be competent for them to remove any existing obstructions which may prevent a perfect inspection of the current carrying conductors, such as laths, plastering, boarding or partitions; and it shall be unlawful for any person to interfere with them in the performance of their duties; and if such installation shall prove to have been constructed in a safe and secure manner, upon the payment of a fee, as hereinafter provided, the Commissioner of Gas and Electricity shall issue a certificate of such inspection, which shall contain a general description of the installation and the date of such inspection. Any owner installing or causing to be installed any electric wires to be hidden from view shall, prior to such installation, give said Commissioner of Gas and Electricity a reasonable notice in order to give ample time for inspection. The use of electric current is hereby declared to be unlawful previous to the issuance of such certificate; provided, however, the Commissioner of Gas and Electricity may issue a temporary permit for the use of electrical current during the course of construction or alteration of buildings, which permit shall expire when the electrical apparatus for such building is fully installed. The head of the department issuing such permit, where a deposit is required to cover inspection fees or for other purposes, may receive a single deposit to cover the liability of one or a number of different persons, firms or corporations, as imposed by the ordinance of the City of Chicago, and in such case shall, at the time of receiving such deposit, enter into an agreement with the persons, firms or corporations, on behalf of whom said deposit is made, wherein among other conditions it shall be stated the purpose for which said deposit is made and on whose behalf, and such agreement shall provide that in case said deposit is anywise depleted to the extent of twenty-five per cent (25%), the persons, firms or corporations on whose behalf said deposit is made shall, within three days after notice of such depletion given by the head of such department to any one of such persons, firms or corporations on whose behalf said deposit is made, deposit a sufficient sum to replenish said fund so that the amount shall be equal to that originally deposited; and, provided, whenever any notice to replenish a deposit shall have been given as herein provided, and said deposit shall not be replenished as herein provided, no permit shall thereafter issue to any of the persons, firms or corporations on whose behalf said deposit was made, unless such person shall first deposit a sum as provided by the ordinances pursuant to which such permit is issued.

833. Certificate—Wiring Only and Complete Installations.) A final certificate for wiring only may be issued by said Commissioner of Gas and Electricity in the case of completed wiring installation, but upon which no current shall be used in the immediate future. Such certificate shall show that at the date of inspection the installation was constructed and erected in accordance with the terms of this chapter, and shall be is-

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sued at nine-tenths the rates hereinafter named for complete installation.

Prior to the introduction of electric current into the said premises a second inspection shall be made, when, if the said installation be still in accordance with the provisions of this chapter, and the fixture work be correct, a final certificate for complete installation and service shall be issued and the amount of the fee paid for the final certificate for wiring only shall be deducted from the fee for the final certificate for complete installation and service.

834. Power of Commissioner of Gas and Electricity—Inspections and Re-Inspections.)

The said Commissioner of Gas and Electricity is hereby empowered to inspect or re-inspect all overhead, underground and interior wires, and apparatus conducting electric current for light, heat, or power, and when said conductors or apparatus are found to be unsafe to life or property, he shall notify the person or corporation owning, using or operating them to place the same in a safe and secure condition within forty-eight hours. Any person or corporation failing or refusing to repair, change or remove the same within forty-eight hours or within such further time as the Commissioner of Gas and Electricity shall determine is necessary, after the receipt of such notice, shall be subject to the penalty hereinafter provided.

834½. Power of Commissioner of Gas and Electricity to Call Upon Police for Assistance.)

Whenever it shall be necessary in the opinion of the Commissioner of Gas and Electricity to call upon the department of police for aid or assistance in carrying out or enforcing any of the provisions of the City of Chicago governing electrical inspections, he shall have authority to do so, and it shall be the duty of the department of police or any member of said department, when called upon by said Commissioner of Gas and Electricity, to act according to the instructions of and to perform such duties as may be required by said Commissioner of Gas and Electricity in order to enforce or put into effect the provisions of these rules and regulations.

835. Poles—Covers—Wires—Electric Service Entrances—Switches.)

All poles now standing or hereafter erected and all covers for manholes now in service, or hereafter placed in service for the use of electric conductors, shall be branded or stamped with the name of the person or corporation owning the same; all electric service entrances shall have attached to the conductor or conductors, in a conspicuous place, a substantial tag designating the owner, and giving such a full description of the conductors as shall meet with the approval of said Commissioner of Gas and Electricity; and all of said electric service entrances shall be properly equipped with approved cutout service switches. Each building into which electric current shall hereafter be introduced shall have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed in conduits; and no wires hereafter put up shall pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used.

836. Fees.) There shall be collected by the City Collector for completed installations, prior to the issuance of certificate permitting the use of electric current, the following fees, in the following manner:

For the inspection of each of the first two arc lamps, one dollar; for three arc lamps, two dollars and eighty cents; for four arc lamps, three dollars and sixty cents; for five arc lamps, four dollars and forty cents; for six arc lamps, five dollars and ten cents; for seven arc lamps, five dollars and eighty cents; for eight arc lamps, six dollars and fifty cents; for nine arc lamps, seven dollars and twenty cents; for ten arc lamps, seven dollars and ninety cents; for above ten to twenty arc lamps, sixty cents each; twenty arc lamps, thirteen dollars and ninety cents; for above twenty to thirty arc lamps, fifty cents each; for thirty arc lamps, eighteen dollars and ninety cents; for above thirty arc lamps, twenty-five cents each.

For incandescent lamps consuming nominally fifty watts each as follows: For each of the first twenty-five incandescent lamps, ten cents; for each of the next twenty-five lamps, nine cents; for each of the next twenty-five lamps, eight cents; for each of the next twenty-five lamps, seven cents; for each of the next one hundred lamps, six cents; for each of the next one hundred lamps, five cents; for each additional lamp above three hundred, four cents; and for larger and smaller lamps under five hundred watts in the same proportion.

For the inspection of incandescent lamps consuming five hundred watts and over: For each of the first two lamps, one dollar; for each of the next three lamps, eighty cents; for each of the next five lamps, seventy cents; for each of the next ten lamps, sixty cents; for each of the next ten lamps, fifty cents; for each additional lamp above thirty, twenty-five cents.

For each electrical horse power of seven hundred and forty-six watts used for mechanical or other purposes than above mentioned, the sum of one dollar for each horse power from one to five horse power, inclusive; for each of the next succeeding five horse power, seventy-five cents; for each of the next succeeding five horse power, sixty-five cents; for each of the next succeeding ten horse power, fifty-five cents; for each of the next succeeding twenty-five horse power, fifty cents; for each of the next succeeding two hundred horse power, twenty-five cents; for each of the next succeeding two hundred and fifty horse power, ten cents; and for each additional horse power, five cents.

No inspection shall be made for a less amount than one dollar.

Inspections of electric lights, other than electric signs as herein defined, placed on a public street or alley for the purpose of illuminating the same; temporary installations for show window exhibitions, conventions and the like; underground or overhead wires and apparatus; and all other inspections not specifically provided for herein shall be charged for according to the time required for such inspections at the rate of seventy-five cents per hour.

Each reinspection of any overhead, underground or interior wires or apparatus shall be charged for according to the time required for such reinspection at the rate of seventy-five cents per hour.

On each installation where a permit has been issued and work not sufficiently completed within three months for wiring only certificate to be issued, and where inspection has been made on such work, a portion of the regular fee must be charged to cover the cost of such inspection, which will be credited on the final certificate.

Immediately after the inspection provided for in Section 832, the Commissioner of Gas and Electricity shall make a fee bill, in duplicate, on a form to be approved by the City Comptroller, and shall forward the same

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American Can Co., Maywood, Ill.—1800 lights, 300 H. P. in motors.	Naperville High School, Naperville, Ill.
American Can Co., Chicago, Ill.—2000 lights, 500 H. P. in motors.	Eleanor Club, Chicago.
New Ford Motor Bldg., Oklahoma City, Okla.—2900 lights, 600 H. P. in motors.	Childs' Restaurant, Chicago.
New Ford Motor Bldg., Omaha, Neb.—4000 lights, 600 H. P. in motors.	RESIDENCES AND THEATRES
Henneberry Printing Co., Chicago—1300 lights, 900 H. P. in motors.	De Koven Bowen, Chicago.
New Pennsylvania Depot, Ft. Wayne, Ind.—1400 lights, 60 H. P. in motors.	W. P. Cowan, Wheaton.
Selz-Schwab Shoe Co., Chicago—600 lights, 75 H. P. in motors.	Barrett Apartment Building, Chicago.
Union Bag & Paper Co., Chicago—1200 lights, 300 H. P. in motors.	Oakland Square Theatre, Chicago.
	Albany Park Theatre, Chicago.
	Central Bldg. Theatre, Cicero, Ill.
	RE-WIRING
	Stock Exchange Building, Chicago.
	The Women's Temple, Chicago.
	Theodore Sheldon, Chicago.
	Commerce Bldg., Chicago.

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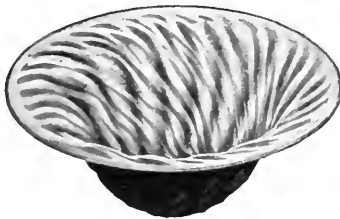
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to the Comptroller to be recorded and rendered. The person, or corporation, receiving the fee bill shall pay the amount thereof to the City Collector, who shall endorse payment thereon and enter the fee bill and payment in a book in his office, to be provided for that purpose, and thereupon the City Collector shall deliver the paid fee bill to the person or corporation paying the same. The paid fee bill shall then be presented to the Commissioner of Gas and Electricity at his office and thereupon the Commissioner of Gas and Electricity shall issue the writing only or final certificate for completed installation provided for in Section 833.

837. **Alterations.**) No alterations shall be made in any electrical installation without first notifying the said Commissioner of Gas and Electricity and submitting the same for inspection in the same manner as provided for new work.

838. **Duty to Test Meters.**) Electrical meters will be tested upon filing proper application with Department of Gas and Electricity.

848. **Penalty.**) Any person or corporation who shall violate any of the provisions of this article or who shall furnish or use any electrical current or install any electrical wires or apparatus shall be fined not less than fifty dollars nor more than one hundred dollars for each offense, and each day's use thereof contrary to the provisions of this Article shall constitute and be a separate and distinct offense. Said Commissioner of Gas and Electricity may, for any violation of the provisions of this Article, also order and compel the cutting off and stopping of such current until the provisions of this Article are fully complied with.

Table of Allowable Carrying Capacities of Wires.

a. The following table, showing the allowable carrying capacity of copper wires and cables of ninety-eight per cent conductivity, according to the standard adopted by the American Institute of Electrical Engineers, must be followed in placing interior conductors.

For insulated aluminum wire the safe carrying capacity is eighty-four per cent of that given in the following tables for copper wire with the same kind of insulation.

Table A. Table B.			Table A. Table B.			
R. & S. G.	Rubber Insulation. Amperes.	Other Insulation. Amperes.	(Circular Mils.)	Rubber Insulation. Amperes.	Other Insulation. Amperes.	
18	3	5	1,624	250,000	240	350
16	6	10	2,582	300,000	275	400
14	15	20	4,107	350,000	300	450
12	20	25	6,530	400,000	325	500
10	25	30	10,380	500,000	400	600
8	35	50	16,510	600,000	450	680
6	50	70	26,250	700,000	500	760
5	55	80	33,100	800,000	550	810
4	70	90	41,710	900,000	600	920
3	80	100	52,630	1,000,000	650	1,000
2	90	125	66,370	1,100,000	690	1,080
1	100	150	83,690	1,200,000	730	1,150
0	125	200	105,500	1,300,000	770	1,220
00	150	225	133,100	1,400,000	810	1,290
000	175	275	167,800	1,500,000	850	1,360
0000	225	325	211,600	1,600,000	890	1,430
				1,700,000	930	1,490
				1,800,000	970	1,550
				1,900,000	1,010	1,610
				2,000,000	1,050	1,670

Materials.
The following is a list of non-combustible, non-absorptive, insulating materials for the benefit of those who might consider hard rubber, fiber, wood and the like as fulfilling the requirements:

1. Glass.
2. Marble (filled).
3. Slate without metal veins.
4. Porcelain, thoroughly glazed and vitrified.
5. Pure sheet mica.
6. Lava (certain kinds of).
7. Alberene stone.

Electric Gas Lighting.

a. Electric gas lighting, unless it is the frictional system, must not be used on the same fixture with the electric light.

Size of Conduit for the Installation of Wires.
Twin Conductor.

Size B. & S.	Conductors in a conduit			
	(1)	(2)	(3)	(4)
	Electrical Trade Size			
14	1 $\frac{1}{2}$	3 $\frac{3}{4}$	1	1
12	1 $\frac{1}{2}$	3 $\frac{3}{4}$	1	1 $\frac{1}{4}$
10	3 $\frac{3}{4}$	1	1 $\frac{1}{4}$	1 $\frac{1}{4}$

Combinations Where Double Braid, Twin or Duplex Wires Are Used.

No. of Wires.	Size Conduit, in. Electrical Trade Size.
*5 No. 14 R. C. solid.....	3 $\frac{3}{4}$
*10 No. 14 R. C. solid.....	1

Where special permission has been given in accordance with No. 26, p. the following table to apply:

18 No. 14 R. C. solid.....	1 $\frac{1}{4}$
24 No. 14 R. C. solid.....	1 $\frac{1}{2}$
40 No. 14 R. C. solid.....	2
74 No. 14 R. C. solid.....	2 $\frac{1}{2}$
90 No. 14 R. C. solid.....	3

*Combinations Where Single Conductor, Single Braid, Solid Wire Are Used.
(This table is not to be used for double braid wires, twin or duplex wires.)

No. of Wires.	Size Conduit, in. Electrical Trade Size.
7 No. 14 R. C. solid.....	3 $\frac{3}{4}$
12 No. 14 R. C. solid.....	1

Size of Conduits for the Installation of Wires and Cables.

Size B. & S.	Conductors in a conduit			
	(1)	(2)	(3)	(4)
	Electrical Trade Size			
*14	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{3}{4}$
*12	1 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$
*10	1 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	1
8	1 $\frac{1}{2}$	1	1	1
6	1 $\frac{1}{2}$	1	1	1 $\frac{1}{4}$
5	3 $\frac{3}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{4}$
4	3 $\frac{3}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{2}$
3	3 $\frac{3}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{2}$
2	3 $\frac{3}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{2}$	2
1	3 $\frac{3}{4}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	2
0	1	1 $\frac{1}{2}$	2	2
00	1	2	2	2 $\frac{1}{2}$
000	1	2	2	2 $\frac{1}{2}$
0000	1 $\frac{1}{4}$	2	2 $\frac{1}{2}$	2 $\frac{1}{2}$
CM				
200,000	1 $\frac{1}{4}$	2	2 $\frac{1}{2}$	2 $\frac{1}{2}$
250,000	1 $\frac{1}{4}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	3
300,000	1 $\frac{1}{4}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	3
400,000	1 $\frac{1}{4}$	3	3	3 $\frac{1}{2}$
500,000	1 $\frac{1}{2}$	3	3	3 $\frac{1}{2}$
600,000	1 $\frac{1}{2}$	3	3 $\frac{1}{2}$	3 $\frac{1}{2}$
700,000	2	3 $\frac{1}{2}$	3 $\frac{1}{2}$	
800,000	2	3 $\frac{1}{2}$	4	
900,000	2	3 $\frac{1}{2}$	4	
1,000,000	2	4	4	
1,250,000	2 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	
1,500,000	2 $\frac{1}{2}$	5	5	
1,750,000	3	5	5	
2,000,000	3	5	6	

*Single Conductor, Single Braid, Solid Wires Only.
(This table is not to be used for double braid wires, twin or duplex wires or stranded wires.)

14	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$
12	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	2 $\frac{1}{4}$
10	1 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	1
8	1 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	



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is greatly enchanced by electric light. During the day the use of electricity in the home is manifold; electric irons, toasters, vacuum cleaners, and numerous other appliances help the housewife to enjoy every hour. At night nothing is more cheerful than a cozy home well illuminated by Mazda Lamps.

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RULES AND INFORMATION PERTAINING TO ELECTRIC SERVICE, METERS AND WIRING OF COMMONWEALTH EDISON CO.

INTRODUCTORY.

These Rules are supplementary to the Electrical Code of the City of Chicago and do not intentionally conflict with that Code in any respect.

All registered electrical contractors in Chicago have been provided with a copy of these Rules. When making contracts for electrical wiring or apparatus, it is recommended that the specifications include the requirement that all electrical wiring and apparatus shall conform to the rules of this Company.

Certain useful information relative to the character of the service in different parts of the City and to the appropriate size and arrangement of meters and service cutouts is included in this book for the convenience of customers and contractors.

The Company is desirous of serving its customers promptly and satisfactorily. It will endeavor to co-operate with contractors and customers to the fullest extent in completing service connections with as little delay and inconvenience as possible, and will gladly give especial attention to any particularly difficult situation confronting a customer.

Anyone desiring information relative to new customers or to additional service at a location already served by the Company should call at the Company's office, or telephone Randolph 1280 and inquire for "Application Bureau."

Anyone desiring information relative to the location of street mains, service outlets or meters, kind of service (direct current or alternating current, single phase or three phase), or similar technical matters, should call at the Company's office, or telephone Randolph 1280, and inquire for "Distribution Division."

Anyone desiring to give or receive information relative to lamp renewals, minor repairs or any interference with the supply of electricity, should call at the Company's office, or telephone Randolph 1280, and inquire for "Service Bureau."

SYSTEMS OF DISTRIBUTION.

Electricity is delivered to customers of the Company by three different systems, viz.:

1. Direct current three-wire Edison, operating at approximately 115-230 volts, for light and power.

2. Alternating current, sixty cycle, single phase, three-wire Edison, operating at approximately 115-230 volts, for light and small power.

3. Alternating current, sixty cycle, three phase three-wire, operating at approximately 230 volts, for power.

4. 440-volt service will be furnished by the Company only for power installations where there is an aggregate rated motor capacity of 250 H. P. or more.

Direct Current Territory.

Electricity is supplied from the Edison three-wire direct current system in approximately the following territory:

North Side. South of Wisconsin Street, east and north of the Chicago River.

West Side. West of the Chicago River to Racine Avenue between Grand Avenue and 16th Street, except on Milwaukee Avenue, where the direct current extends to Wood Street; and on West Madison, where it extends to Ashland Avenue, and on Blue Island Avenue, where it extends to Throop Street.

South Side. From the Chicago River to 35th Street between Stewart Avenue and Cottage Grove Avenue. From 35th Street

to 39th Street between Dearborn Street and Grand Boulevard, and on Cottage Grove Avenue from 35th to 38th Streets.

Alternating Current Territory.

Electricity is supplied from the alternating current Edison three-wire system for lighting and small power in all other parts of the city where the Company has mains.

It is important that inquiry be made at the Distribution Division of the Company as to the character of the service which will be given in locations which are near the dividing lines above described, as these boundaries are subject to change at any time and alternating and direct current lines overlap each other in some places.

SERVICES.

It is essential, in order to avoid error, that the customer inform himself at what point the Company's service lines are to be brought to his building. In order to assist the customer in securing such information, special forms have been provided which can be secured upon request. The Company, on receipt of one of these forms properly filled out, will designate the point of service entrance and also the character of service to be supplied.

The Company will not be responsible for mistakes of any nature whatever, resulting from information relative to the character of its service or location of its mains given verbally or over the telephone unless such information is confirmed in writing by the Company.

Overhead.

The customer's wiring must be brought outside of the building wall at a point which will be as accessible as possible to the Company's distributing line. If possible, the position of the outlet should be such that service wires can be brought from the Company's nearest pole without crossing the adjacent property.

Except as hereinafter noted, the Company will install free of charge, for any customer, one overhead service connection, approximately 100 feet in length. All poles and other supports, and all wires in excess of 100 feet, required on private property, in order to reach the customer's service outlet, must be paid for by the customer.

For buildings of more than one story in height, the service outlet must be brought at least to the level of the ceiling of the second floor, and for buildings of less than two stories in height, must be carried to the highest point of that part of the building at which such outlet is located.

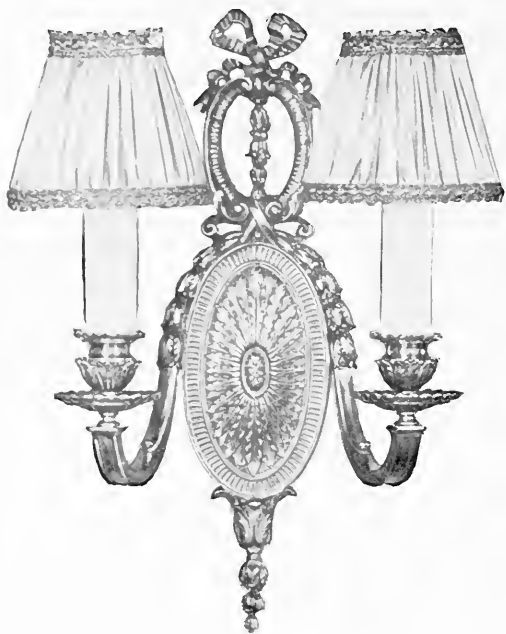
Where the position of a building is such that the service outlet cannot be located at a point which may be reached by a single span from the pole line or where the outlets of a low building must be brought out less than 10 feet above the ground, some form of intermediate support of suitable strength and height must be provided by the customer.

When the intermediate support is a pole or timber placed in the ground, it must not be less than 6 inches by 6 inches, and 16 feet long, 3 feet of which is to be set in the ground.

When the support consists of a riser attached to the building to which electricity is to be furnished, the riser must be at least 1 inches by 4 inches, fastened to the building by bolts.

The pole or timber mentioned above and the riser must be of clear, sound, straight-grained fir, pine, or cypress wood.

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For every type of building we have in our large stock, or can make up, a suitable type of lighting fixture.

We not only make fixtures but install them—anywhere. Our designing and engineering department can render the service that every architect so often requires.

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The Company cannot utilize as intermediate support adjacent buildings not on the property which is being served.

The service outlet must be so located that there will be at least 24 inches clearance between it and any telephone or signal wires attached to the building and at least 36 inches clearance between the service drops of both systems in an open span.

The service wires must, in no case, be within easy reach from porches, windows or any other part of the building ordinarily accessible to the occupants.

In case a pole line from which service is to be given is not in position at the time the interior wiring is being done, inquiry should be made at the Distribution Division of the Company for information as to the location of the service outlet.

Separate service will not be installed for more than one building on the same premises for the same customer, except at the customer's expense.

Not more than one service will be installed for lighting or for the same class of power on the same premises, except at the customer's expense.

A service will not be installed in a private garage or other out-building where the customer's installation is less than 300 watts, except at the customer's expense.

Underground.

Where the space beneath the sidewalk is excavated, the service cables will be terminated at a point about three feet inside the curb wall, and the wiring installed by the customer must be brought to the nearest service entrance, if there be one within 50 feet of his premises.

Where there is no sidewalk excavation and where there is a basement within 10 feet of the street or alley from which service is to be introduced, the service cables will be terminated at a point about 3 feet inside of such basement wall.

Where no basement is available within 10 feet of the street or alley line, the service will be extended underground from a point 10 feet inside the property line at the customer's expense to any point which he may designate.

In case the customer does not wish to bear the expense of an underground service across his property, the underground service will be brought up on a pole at the lot line. The pole and overhead service to the building will be installed at the customer's expense, unless the customer is willing to permit the Company to use the pole to supply other customers.

Where the customer desires to install underground service from an overhead line, conduit must be installed by the customer from the building to the base of the pole from which the service is to be taken, and the customer must furnish sufficient lead-covered cable and likewise sufficient conduit to extend from the service switch to the cross arm on the pole. The cable must be installed in the underground conduit by the customer. The Company will install the conduit and lead-covered cable furnished by the customer from the base of the pole to the cross arm. The Company will make the final connection between the underground cable and the overhead wires in every case.

Where there is no service available, application should be made to the Contract Department of the Company, to have service installed.

Transformer Vaults.

In alternating current districts where, for any reason, it is undesirable to install transformers on poles outside the building, they may be installed in a fire-proof vault or room inside the customer's premises, conveniently accessible to the point of entrance of the service cables.

This vault, or room, must be constructed by the customer in accordance with rules 14 and 45 of the Electrical Code of the Department of Gas and Electricity of the City

of Chicago and, further, must be constructed in accordance with the following specifications:

(a) The square feet of floor space required for this room depends upon the transformer capacity and shall be as shown in the following table:

Up to and including 20 k. w.—36 square feet per transformer.

25 to 100 k. w. inclusive—50 square feet per transformer.

Larger than 100 k. w.—to be determined by special ruling of the Distribution Division of the Company in each case.

All transformer vaults or rooms are to have clear headroom of 8 feet.

(b) A suitable fire-proof door of standard height and not less than 40 inches in width must be provided.

This door should be so arranged as to facilitate the moving of transformers in or out of the room. A standard padlock for the door will be provided by the Company.

(c) In cases where the transformer room is located above the ground floor and transformers cannot be taken to or from the room by means of an elevator, a permanent provision must be made by the customer for hoisting the transformers to the floor on which the room is located. Such hoisting facilities must be suitable for handling a load of approximately 3,000 pounds.

(d) Ventilation must be secured by means of an air inlet placed not more than 1 foot above the floor and an outlet at the ceiling line. The area of the inlet and the outlet must not be less than 100 square inches per 100 kilowatts or fraction thereof of transformer capacity. These openings should, when exposed to the weather, be protected by a louvre or some other means of preventing the entrance of rain or snow. The openings inside of the building must be protected by a suitable screening.

(e) The necessary connections from the high tension cables to the transformers and from the transformers to the secondary bus in the transformer room will be provided by the Company. The customer's wiring must be extended into the room and provided with suitable lugs to be connected to the Company's secondary bus. The secondary service switch must be installed at the most available point immediately outside the transformer room. The division of expense of installing the primary cables and conduit entering the premises will be determined in accordance with the general rules for underground services.

WIRING.

General Rules.

1. Wiring should be so arranged that a separate meter may be installed for each class of service supplied under the various rates shown in the Company's Schedule of Rates.

2. The general retail lighting service, including service for motors having a total rated capacity not exceeding 1 H. P. and small household utensils, is supplied under Rate "A."

3. Regular power service for motors of over 1 H. P. of aggregate rated capacity will be supplied under Rate "B."

Power is defined as electric service used for any purpose other than illumination. Service for photographic printing lamps, bath cabinets, resistance lamps and similar devices which are not used for general illuminating purposes will be considered as power and should be wired accordingly.

4. Where the Company furnishes electricity under its Rate "C" for larger users, provision must be made by the customer at the service entrance for the installation of one set of meters for the measurement of all electricity for both light and power. In the case of alternating current service, however, a separate meter may at the option of the Company be installed for the lighting service.

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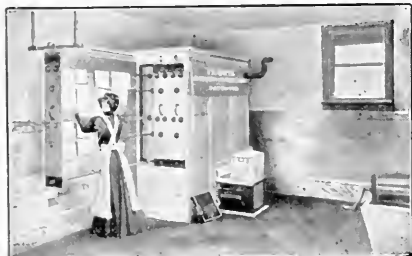
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Every residence and apartment lighting installation which does not exceed 2,640 watts or 48 sockets must have a 2-wire service main and 2-wire meter loops, as such an installation will be connected to the Company's system by two-service wires at 115 volts. Unless the installation exceeds 2,640 watts or 48 sockets the Company will not connect it by a 3-wire service.

Every business lighting installation of over 1,320 watts or 24 sockets must have a 3-wire service main and 3-wire meter loops. If the installation is 1,320 watts or 24 sockets or less, it should be wired with a 2-wire service main and 2-wire meter loops.

Single stereopticons, outlets for battery charging and other devices which are most economically operated at 115 volts will be approved for this voltage. Where more than one such device is installed in the same premises, they must be connected to a 3-wire main and balanced as nearly as possible.

Every alternating current vehicle charging mercury arc rectifier in a private garage must be connected to the customer's lighting service providing such a service is already installed. If the existing lighting service is a 2-wire service, a third wire should be run out.

If at the time the rectifier is installed there be no existing lighting installation in the premises and later the customer desires to put in a lighting installation, such installation should be wired for a 3-wire service.

In a private garage using vehicle battery charging service, the lighting circuits for the garage must be connected to the meter for the battery charging service.

In theatres, single-phase or direct current motors, and moving picture and spot arcs should be connected to the same meter.

Where transformers are used in connection with moving picture arcs or spot arcs they must be operated at 230 volts.

Cutouts.

Fuse blocks and service switches must be equipped with fuses of the proper type and capacity at the time of their installation.

Three-wire service switches or cutout blocks for branch mains, except three phase, must have no fuse in the neutral wire.

In cases where cartridge fuses are installed, the Company will not furnish free renewals.

Switches and fuse blocks should not be installed above or in close proximity to laundry tubs, sinks, or other plumbing fixtures.

Sockets.

All sockets must be designed for use with Edison base lamps.

Grounding Conduit on Neutral Service Wire. The use of the neutral service wire for grounding conduit is not permitted. The conduit should preferably be grounded to the cold water piping system.

Welders, Furnaces, X-Ray and Wireless Telegraph Coils.

In general, a separate service outlet should be provided for all electric welders or furnaces having a capacity of over 20 kilowatts.

A separate outlet must be provided for X-Ray apparatus, wireless telegraph coils and other similar devices. The cost of the service connection for wireless telegraph and X-Ray apparatus will be charged to the customer.

Where X-Ray and wireless telegraph apparatus require more than 2,000 watts, the coils must be wound for 230 volts.

In connection with wireless telegraph equipment, a suitable condenser and spark gap must be installed by the customer. No ground will be permitted in connection with the equipment except that on the side of the oscillation transformer to which the antenna are connected. This rule may be waived when a motor generator set is employed to convert the electricity received from the Company's service into another

form. All high tension wiring used in connection with the apparatus must be kept away from the meter and wiring of the building.

Voltage Regulation.

The wiring installed in the customer's premises should be of such capacity that the entire connected load can be carried with a loss in voltage of not more than 2% between the service entrance and the most remote lamp on the premises.

Switchboards.

Specifications and blue prints for service and meter switchboard installations should be submitted to the Distribution Division of the Company for approval before construction on the switchboard is begun.

Fuses should be so arranged that they will be readily accessible for the purpose of replacement, and to this end it is recommended that no more than three rows of switches be placed on a switchboard.

The general arrangement of the connections on the back of the board should be such as to make it possible to make repairs or alterations with a reasonable degree of facility and safety while the board is in service.

The bus bars should be rigidly supported so as to prevent any sag and the arrangement of the feeder cables between the terminal of the conduit system and the back of the switchboard should be made in a systematic and orderly manner and the cables should be segregated as far as possible with a view to minimizing the possibility of serious interruption to the service. For details concerning the installation of meter test links and other matters pertaining to switchboard meters.

Auxiliary or Breakdown Service.

Where a customer contracts to use the Company's service as an auxiliary or breakdown service in connection with his usual source of supply, he must, in case the number of kilowatts which the Company is obliged to stand ready to supply under the contract be less than the estimated maximum of the customer's plant, as estimated by the Company, furnish and install a circuit breaker approved by the Company, which shall be set to break the connection with the Company's service in case his maximum demand shall at any time materially exceed the number of kilowatts which the Company has agreed to supply.

The circuit breaker must be installed by the customer at a suitable location between the Company's meter and the customer's load and must be in a steel cabinet which can be sealed by the Company.

Additions and Alterations.

When any change in the size of a customer's installation is made, the Company must be advised, so that it may inspect such installation and provide service and meter of the proper capacity. If alterations are to be made in a building, which may disturb the electric wiring and require the moving or removal of the Company's meter, the Company must be notified in advance in order that the changes may be given prompt attention. If it is necessary to move the meter to a new location, such removal will be made if meter loops are provided. A temporary location and meter loops must be provided by the customer, if electricity is desired during such alterations, but under no circumstances will electricity be furnished without a meter.

Alternating Current.

In general, wiring should be so arranged that all motors of $\frac{3}{4}$ H. P. or more may be connected to a separate service and meter.

All alternating current motors which start frequently, such as those operating coffee mills, meat grinders, shoe repairing machines, electric pianos, pumps and carbonators, must be wired for and operated on 230 volt service.



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Stationary vacuum cleaner and pump motors in houses and apartments may be connected to the lighting service if the motor is less than 1 H. P. and in the case of vacuum cleaner motors is wound for 115 volts. Pump motors must be wound for 230 volts. Vacuum cleaner and pump motors of 1 H. P. or more should be wired for a separate service connection. Permission may in some cases be obtained from the Distribution of the Company to connect larger vacuum cleaner or pump motors to the lighting service, depending upon the size of the building and the capacity of the Company's line.

No motors larger than 5 H. P. will be supplied on the single-phase system except by special permission given in each case by the Distribution Division of the Company.

Three-phase service will not be provided for installations aggregating less than 5 H. P. unless the customer deposits with the Company a sum equivalent to the excess cost to the Company of installing a three-phase service over and above the cost of installing a single-phase service. In case the customer's power installation shall subsequently be increased to a total rated capacity of 5 H. P. or more, the Company will return the amount of the deposit to the customer.

Motors of 5 H. P. or more are supplied from the three-phase system in a large part of the alternating current territory, but inquiry should be made of the Distribution Division of the Company as to the proximity of three-phase lines to any particular location where such power may be desired.

All motors of $7\frac{1}{2}$ H. P. rating, and above, must be equipped with starting apparatus.

Motor starting equipments must be so arranged that in case of an interruption of the power supply the connections will be thrown to the starting position or the circuit opened entirely.

Motors of above 50 H. P. must be of the slip ring or wound rotor type, except that where the lighting service will not be seriously disturbed, squirrel cage type motors may be used to drive direct current generators if permission is secured in advance from the Distribution Division of the Company.

Reverse phase relays must be installed on all three-phase elevators, crane and similar installations in order to prevent accidents in case any of the phases be reversed.

The power factor of all motors of more than 5 H. P. or other inductive apparatus requiring more than 5 K. V. A. must be at least 80 per cent when operating at their rated load.

METERS.

Location.

All meters must be installed in a suitable location as near as practicable to the point where the service enters the building. The wires should be enclosed in a continuous metal conduit from the service to the meter. In office buildings, special meter closets of ample size should be provided on each floor; in apartment buildings, all meters should be installed in the basement, and the separate circuits to each apartment should be carefully labeled. In residences, meters should be installed in the basement or a rear hall, rather than the attic.

The requirements of a suitable meter location are as follows:

(a) Meters should be accessible to the Company's employees at all times, and should be so located that they may be easily read, inspected and tested, with a minimum of annoyance to the tenants. They must be installed not more than seven feet from the floor, and must not be placed in bedroom closets, bath or toilet-rooms, or in any room commonly kept locked, in or near coal-bins, over doors, in elevator or ventilating shafts, near stoves, radiators, or steam or gas piping.

(b) The location selected must be free from moisture. A watt-hour meter must

never be placed under a water pipe, from which, as a result of sweating, water may drip. When a damp location is unavoidable, a moisture-proof cabinet must be provided by the customer to contain the meter.

(c) The location must be free from vibration. Where a building faces on a street on which traffic is heavy, or cars are passing, meters should preferably be placed upon a wall at the building line, rather than upon the front curb wall. They must not be placed on any insecure partition or over a doorway.

(d) Meters should be located if possible so that they will not be exposed to mechanical injury. If this is unavoidable, a suitable cabinet must be provided by the customer to contain the meter, and to thoroughly protect it from possible damage.

(e) The meter location must be as free as possible from magnetic disturbance. Meters must not be installed in close proximity to motors or generators. Cabinets where necessary for direct current meters must be of asbestos board or non-magnetic metal.

Meter cabinets must be of ample size to permit the safe handling of wires when connecting, disconnecting or testing the meters. If the conditions require the installation of a metal cabinet, the inside should be lined with suitable insulating material.

Installation.

Meter loop fittings are required by a city ordinance to be provided on all installations where the mains are of No. 2 B. & S. gauge or smaller. On mains larger than No. 2 B. & S. gauge conduit fittings or standard meter loop fittings of proper capacity must be used.

A type of meter loop fitting is recommended in which the wires between the fitting and the meter are protected with a metal housing and embodied in which is a meter test block. This type of fitting renders the customer's installation less liable to disturbance and his service is not interrupted by meter testing operations.

Where meter loops are provided, a free end of at least 24 inches must be left to give ample wire for connection to the watt-hour meter, or if the wires are left in the form of loops, each loop must contain at least 18 inches of wire.

Meter loops must be so arranged that the meters can be placed at least 6 inches away from iron cabinets and cutout boxes, to permit the safe handling of wires during tests.

The distance between centers must not be less than 12 inches for A. C. and 15 inches for D. C. meters. Meters of a capacity in excess of 50 amperes should have a distance between centers of not less than 24 inches, and the leads of one meter should not run within 12 inches of another meter.

The general arrangement of meter loops should, if possible, be such that a meter can be installed without crossing any wires. If this is impracticable, sufficient flexible tubing must be left on the wires to make possible an installation which will be in accordance with the rules of the Department of Gas and Electricity of the City of Chicago.

When meters are installed for construction work, cabinets of weather-proof construction must be provided by the customer, to protect them against injury. The Company will provide an independent cabinet for its service switch and service fuses, and each individual sub-contractor is required to provide his own meter cabinet and install the necessary wiring between this cabinet and the Company's service switch. The final connections between this wiring and the Company's mains, are, in every instance, to be made by the Company. When it is possible, a location should be selected for a meter at the outset which can be used throughout the construction period.

Where several meters are grouped together, the circuit to which each one is connected should be plainly indicated, and all circuits should be carefully traced to insure that there is no error in the wiring, whereby

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one customer obtains current through another customer's meter.

Both sides of a 230 volt, two-wire alternating current circuit must be carried through the meter. This practice should mit the safe handling of wires during tests, also be followed on direct current, 230 volt, two-wire circuits, for meters up to and including 50 amperes capacity.

Both outside wires of all 230 volt, three-wire circuits must be carried through the meter and, in the case of direct current installations, a neutral potential tap must also be provided.

Potential taps must be so made that they cannot become disconnected. The connecting wire should be as short as possible, and must be soldered to the return or neutral circuit without a fuse.

All watt-hour meters and maximum demand indicators must be protected by suitable fuses. Meters must never be placed between the service mains and the service switch.

Where more than one meter is dependent on the service switch, fuses must be provided in such a manner as to protect the meter where the meter is supplied by mains larger than No. 10 B. & S. gauge.

The Company will install only one meter or one unified set of meters for one class of service.

A monthly rental charge for each additional watt-hour meter is made by the Company where, at the request of the customer, and for his convenience, more than one meter is installed on his premises for one class of service. This rental charge is based on the size of the meter installed.

A suitable meter board not less than $\frac{3}{8}$ -inch thick must be provided by the customer. Specifications, prepared by the Department of Gas and Electricity of the City of Chicago, show the necessary dimensions of these boards for installations of outlet fittings, watt-hour meters, and maximum demand indicators, under 100 amperes capacity.

Types and Dimensions.

Space should be provided for the installation of two maximum demand indicators on three-wire circuits.

Standard three-wire meters are used on the three-wire Edison system where the load on each side is 150 amperes or less. Direct current installations requiring meters of larger capacity will be provided usually with two meters, one on each side of the three-wire system. Current transformers are used in connection with alternating current meters, when the load is in excess of 150 amperes.

Current and potential transformers are required on meter installations on primary lines. Ample space should be allowed for the installation of current and potential transformers when these are required.

Standard front-connected types of meters are used up to a capacity of 600 amperes. Larger meters are usually back-connected switchboard type. For installations requiring a meter capacity of over 1,500 amperes it is customary to install two or more meters in multiple.

The Company should be consulted whenever it is necessary to know in advance the type and size of the meter which a given installation will require. Information relative to the type of watt-hour meters and maximum demand indicators to be used on large installations must be obtained from the Distribution Division of the Company before wiring is completed.

Switchboard Meters.

Switchboard meters and the necessary equipment therefor will be furnished by the Company for large installations if the customer makes arrangements with the Company in advance and provides for the necessary drilling and connections for both meters and equipment. Demand indicators, printometers, contact-making clocks and relay switches are part of the meter equip-

ment. Proper templates and wiring diagrams will be furnished by the Company.

Test links must be installed with all switchboard meters. For 2-wire meters, two test links are required, one on the service side and one on the load side of the meter, in the side of the circuit passing through it; for 3-wire meters, four test links are required, one in each of the service leads to the meter, and one in each of the load leads from the meter. Test links should be located on the front of the switchboard; or if this is not practicable, arrangements may be made to mount them on a separate panel, placed at the back of the board, in the same plane with the fuse panels. The meter test links which are approved by the Company are shown on pages 62 and 63. The test terminals, studs and links will be furnished by the Company and are to be installed at the expense of the customer. In all cases, test links must be readily accessible and placed at a sufficient distance from the switches, bus bars and switchboard frame, to eliminate, as far as possible, danger from short circuits while making connections for tests.

Various details, such as the method of metering, the type and capacity of watt-hour meters and maximum indicators, and the size of test links, must be determined by the Company for each switchboard installation. These details should be taken up with the Distribution Division of the Company by the customer or his representative before the board is designed, and sufficiently in advance of its construction to give the Company time to obtain the special equipment. Blue prints or sketches showing the proposed location and connections of meters and equipment on switchboards must also be submitted to the Distribution Division for approval, before the switchboard is constructed. See "Switchboards."

LAMPS.

Contractors' Lamps.

In the case of buildings under construction, arc or incandescent lamps will be furnished only on condition that the user deposit with the Company an amount equal to the value of such arc or incandescent lamps as are furnished by the Company. The value of the lamps not returned intact when such user discontinues the Company's service at that location, will be deducted from said deposit.

Incandescent.

Where a customer, whose contract entitles him to the Company's lamp service, requests the Company to furnish Mazda lamps of 100 to 500-watt sizes in exchange for lamps of less wattage, such lamps will be furnished subject to the rules of the Department of Gas and Electricity of the City of Chicago with regard to the number and wattage of lamps to be carried on the circuits.

INSPECTION.

All wiring which is to be connected with the Company's service must be inspected and approved by the Department of Gas and Electricity of the City of Chicago, and must conform to the rules and regulations established by the Company from time to time.

A Temporary Current Permit, or Certificate of Installation, issued by the Department of Gas and Electricity of the City of Chicago must be presented at the office of the Inspection Bureau of the Company before the electricity can be turned on. This applies to additional wiring which may be connected at any time, as well as to original installations. The Company reserves the right to make final connection of all wiring to its mains and in case any damage results from unauthorized connections the customer will be held responsible for such damage.

Every electrical contractor is urged to stencil his name, address and telephone number on the service, cutout cabinet or meter board. This information will enable the Company to communicate promptly with the contractor when necessary.

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INDEX TO RULES

	RULES		RULE
Air compressed	13	Piping, for fuel only.....	18
Alterations in house piping, etc.....	79-80	“ for laundry	36
Appliances, connecting	15	“ how to avoid trapping.....	10
“ domestic and industrial, feet of pipe		“ inspection of	1
allowed	27	“ imbedded in concrete or cement.....	9
Automatic water heater, feet of pipe allowed.....	28	“ obstruction in	3
Building Service, bringing to street service.....	74	“ on outside wall.....	7
“ “ feet of pipe allowed.....	30	“ on masonry wall.....	8
“ “ finished rooms in basement.....	59	“ office building, schools, hospitals, residences	
“ “ header	65	and flats	23
“ “ only, installing	52	“ plans 1 and 2.....	31
“ “ in flat or residence.....	53	“ rooms in rear of store.....	26
“ “ in store	54	“ stores and factories.....	24
“ “ in unheated basement.....	57	“ testing of	2
“ “ laid through a masonry wall.....	62	Pipe, single pipe system.....	17
“ “ location of	60	“ size required and equivalents.....	20
“ “ opening in	63	Riser, distance below ceiling.....	44
“ “ solid wall porch.....	58	“ for theatre	35
“ “ test pipe on.....	64	“ height of	43
“ “ terminating	75	“ in rear of a basement.....	60
“ “ under ground	55	“ in other apartments.....	40
“ “ wrapping	61	“ in laundry, etc.....	34
Branch lights, feet of pipe allowed.....	25	“ in cold basement.....	37
Branch lines, drops from.....	12	“ in front hall.....	42
Breaking sizes of pipe.....	11	“ location for	33
Compressed air	13	“ near a vestibule partition.....	38
Defective material	4	“ near an electric cut-off box.....	39
Drops from branch lines.....	12	“ prohibited location for.....	41
“ distance below ceiling.....	50	“ size of for combined line.....	22
Electric cut-off box.....	29	Rules, understanding	19
Equivalents, table	20	Sizes, breaking	11
Exit lights	45	Single pipe system.....	17
Gas engines, feet of pipe allowed.....	29	Services, disconnecting and reconnecting.....	77
Inspection of piping.....	1	“ for apartment buildings.....	67
Light for top floor hall.....	46	“ for building in rear of corner lot.....	70
“ “ public hall (3 flat building or over.....	47	“ for corner buildings.....	69
“ “ “ 2 flat building.....	48	“ for court buildings.....	68
Meter, changing location of.....	78	“ building in rear of lot.....	71
“ disconnecting and reconnecting.....	77	“ for stores	66
“ location for	32	“ opening in wall for.....	72
Material, defective	4	“ opening in floor for.....	73
“ not allowed	5	“ two in one trench.....	56
Masonry Walls, piping on.....	8	Typesetting machines	16
Openings, size of, how to determine.....	21	Water heater, automatic, feet of pipe allowed.....	28
Outlets, for mantel or fireplace.....	51	Window lights, feet of pipe allowed.....	25
“ for fuel, height of.....	49	Work charged for by company.....	80
“ capping of	6	“ done by company free of charge.....	79
“ for fuel	18	“ not allowed	14
Outside wall, piping on.....	7	“ reserved by company.....	76

The following rules governing the piping of buildings for the distribution of gas for light and fuel have been adopted by The Peoples Gas Light and Coke Company.

General Instructions.

1. Inspection of Piping. Piping should be inspected by the Gas Company both after it is completed and before the interior of the building is lathed or covered. It must be inspected again after the building has been completed and before the fixtures are installed. Twenty-four hours' notice will be required for each inspection. Gas fitters must have the work completed and the piping tight before they notify the Gas Company to make these inspections.

2. Testing. Before fixtures are installed, the piping must stand a pressure of 6 inches on a column of mercury without showing any drop in the column for a period of ten minutes.

After fixtures are installed, piping must stand a pressure of one inch on a column of mercury without showing any drop for the same period of time.

3. Obstructions in Pipe. All piping must be free from burrs and other obstructions.

4. Defective Material. Split pipe or fittings repaired with cement or lead must not be used. Caulked fittings must not be used.

5. Material Not Allowed. Unions or bushings must not be used in work that is to be concealed, and cast iron fittings are prohibited in either exposed or concealed work.

6. Capping Outlets. All outlets must be securely closed with iron caps until fixtures or appliances are installed.

7. Piping on Outside Wall. When it is absolutely necessary to run pipe on an outside wall a furring strip must be placed between the pipe and the wall.

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8. Piping on Masonry Walls. All piping run on masonry walls must be securely fastened thereto by strapping it to wooden plugs driven into the wall.

9. Imbedding in Concrete or Cement. When pipe is to be imbedded in concrete or cement, it must be covered with tar paper or other suitable covering, or laid in a conduit pipe.

10. Trapping Pipe. To avoid trapping pipe gas fitters must grade it to riser or to drops, except as provided in rule No. 66.

11. Breaking Sizes. In every case where an extension is to be made, pipe must be broken at a point where the full size can be maintained.

No extension must be made from a pipe of a smaller size.

12. Drops from Branch Lines. Drops on branch lines should have a set of 4 inches and they must be dropped square. Outlets for side brackets may be either square bends or long drop ells. The use of nipples is prohibited.

13. Compressed Air. Compressed air must not be used for industrial appliances.

14. Work Not Allowed. Gas fitters must not do any underground piping outside of a building.

15. Connecting Appliances. Fitters are particularly requested to see that all gas burning appliances are connected solid with iron pipe. Under no circumstances will this Company approve of the use of lead pipe or rubber tubing.

16. Typesetting Machines. A linotype or monotype machine must be supplied by a separate fuel run.

Rules and Tables for Piping.

17. Single Pipe System. The following tables and rules provide for a single pipe system in either new or old buildings. However, should it be more economical to install a double pipe system, such may be installed, and outlets computed on the same basis as that for a single pipe system.

18. Fuel Only. When piping is installed for illumination in either a new or old building, an outlet must be left for fuel.

If gas for light is not desired, a building may be piped for fuel only.

19. Understanding Rules. If, in any instance, the rules governing the sizes of pipe to be installed are not clearly understood, or if unusual conditions not covered by the rules are met with, the Gas Company should be consulted.

20. Size of Pipe Required and Equivalents. The amount of gas passing through a $\frac{3}{8}$ -inch pipe under normal pressure is approximately 10 cubic feet of gas an hour. The capacity of a $\frac{3}{8}$ -inch outlet has therefore been called an equivalent, and the table of pipe sizes below has been figured out on that capacity and is to be used in estimating the size of the pipe necessary to give an adequate supply of gas to an appliance.

For example, a range for a flat or residence requires five times the quantity of gas supplied by a $\frac{3}{8}$ -inch pipe, or five equivalents.

Range for flat or residence.....5 equivalents
Grate or log.....3 "
Laundry appliance.....3 "
Water Heater4 "
Are Lamp2 "

The number of $\frac{3}{8}$ -inch equivalents for any appliance not mentioned in the above table may be determined by dividing the

total consumption per hour of that appliance by ten.

Consumption of gas-fired steam boilers may be obtained by assuming 80 cubic feet of gas per hour for each horsepower.

21. Size of Opening. To determine the size of the opening required when risers are connected at the meter end, the combined loads of the risers must be added together. (See table in Rule 23.)

22. Size of Riser for Combined Lines. When two or more lines of pipe are connected in order to be supplied by one riser, the riser must be of sufficient size to supply the combined load of all the lines. (See Rule 23.)

23. Office Buildings, Schools, Hospitals, Residences and Flats, Under Single Pipe System.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of $\frac{3}{8}$ -inch Equivalents allowed
$\frac{3}{8}$	30	2
$\frac{1}{2}$	40	4
$\frac{3}{4}$	60	10
1	70	15
$1\frac{1}{4}$	100	30
$1\frac{1}{2}$	150	60
2	200	100
$2\frac{1}{2}$	250	200
3	300	300
4	450	500

Notes: Any ceiling 20 feet high or over must have $\frac{1}{2}$ -inch drops.

In a residence or a flat building, a $\frac{3}{4}$ -inch outlet for a range in a kitchen may be used to supply two appliances, such as a range with a $\frac{3}{4}$ -inch outlet extended full size, and a water heater or a laundry appliance with a $\frac{1}{2}$ -inch extension.

24. Stores and Factories.

Size of Pipe Inches	Feet of Pipe Allowed	Number of $\frac{1}{2}$ -inch Outlets allowed
$\frac{1}{2}$	30	1
$\frac{3}{4}$	60	8
1	70	12
$1\frac{1}{4}$	100	20
$1\frac{1}{2}$	150	35
2	200	50

Notes: For stores the running line must not be less than $\frac{3}{4}$ -inch to the last outlet.

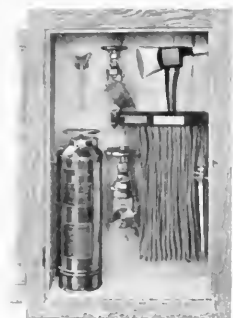
Drop outlets for stores must be $\frac{1}{2}$ -inch in size.

25. Bracket and Window Lights. Thirty feet of $\frac{3}{8}$ -inch pipe will be allowed for bracket lights. The same length of $\frac{1}{2}$ -inch pipe will be allowed for window lights.

26. Piping Rooms in Rear of Store. When a store building with living rooms in the rear is supplied by one riser, the running line must be $\frac{3}{4}$ -inch to the outlet for fuel.

27. Domestic and Industrial Appliances. Gas to be used at one point.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of $\frac{3}{8}$ -inch Equivalents allowed
$\frac{1}{2}$	80	4
$\frac{3}{4}$	90	10
1	100	20
$1\frac{1}{4}$	150	30
$1\frac{1}{2}$	200	40
2	250	60



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28. Automatic Water Heaters. An automatic water heater must be supplied with a separate pipe. For sizes and lengths allowed see table under this rule.

Pipe run to supply any automatic water heater, not shown in the following table, must be one size larger than the opening of the appliance. The length allowed may be ascertained from table in Rule 27.

Humphrey Heater	Pittsburg Heater	Ruud Heater	Size of Pipe in Inches	Feet of Pipe Allowed
20.....	...	1½	1	100
30.....	...	...	1	100
2A to 2C....	2	...	1	100
		2½	1	100
3A to C.....	3	3	1	100
4A to C.....	4	4	1½	150
6A to C.....	6	6	1½	200
8A to C.....	8	8	2	250

29 Gas Engine. The gas supply for a gas engine must be separate. An independent service will be required, and a governing holder or other similar device acceptable to the Company must be used. Before any work of installing a gas engine or piping for one is done, consultation with the Gas Company is advised.

Horse-power	Size of Pipe in Inches	Feet of Pipe Allowed
1 to 7.....	1	100
8 to 12.....	1¼	100
13 to 22.....	1½	100
23 to 35.....	2	100
36 to 50.....	2½	100
51 to 100.....	3	100
101 to 150.....	4	200

Note: If the length of pipe required exceeds the number of feet allowed, the allowable length may be doubled by increasing the pipe one size.

30. Building Services.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of ¾-inch Equivalents allowed
1	70	16
1¼	100	40
1½	150	80
2	200	120
2½	250	200
3	300	300
4	450	500

Note: All openings in a building service must be of the same size as that of the riser which in no case must be less than ¾ inch in size.

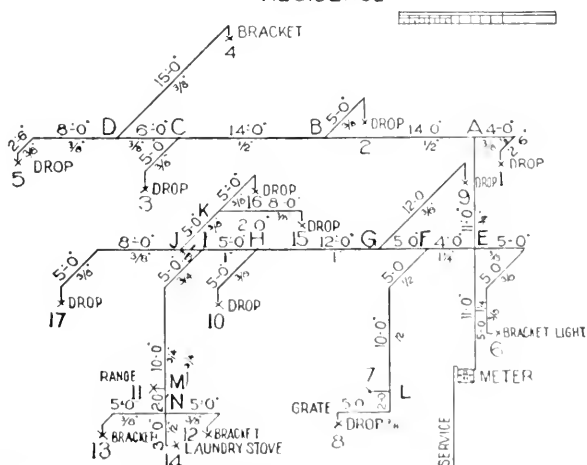
31. Plans of Piping and Their Explanation.

In determining sizes of piping for a building the starting point must be the extreme end of the system and all calculations must be made from there on to the meter.

Plan No. 1. Residence.

Line	Number of ¾-inch Equivalents supplied by line	Length	Size
5 to D	1	10' 6"	¾"
4 to D	1	15'	¾"
D to C	2	6'	¾"
C to 3	1	5'	¾"
C to B	3	14'	¾"
2 to B	1	5'	¾"
B to A	4	14'	¾"
1 to A	1	6' 6"	¾"
A to E	5	11'	¾"
J to 17	1	13'	¾"
K to 16	1	5'	¾"
K to 15	1	8'	¾"
K to J	2	5'	¾"
J to I	3	2'	¾"
N to 14	3	3'	¾"
N to 13	1	5'	¾"
N to 12	1	5'	¾"
N to M	5	2'	¾"
I to M	10	15'	¾"
I to H	13	5'	1"
H to 10	1	5'	¾"
H to G	14	12'	1"
9 to G	1	12'	¾"
G to F	15	5'	1"
8 to L	1	7'	¾"
L to F	4	15'	¾"
E to F	19	4'	1¼"
6 to E	1	15'	¾"
E meter	25	11'	1¼"

SAMPLE PIPING PLAN
RESIDENCE



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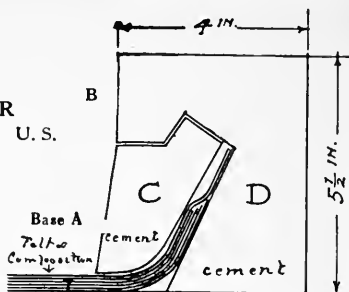
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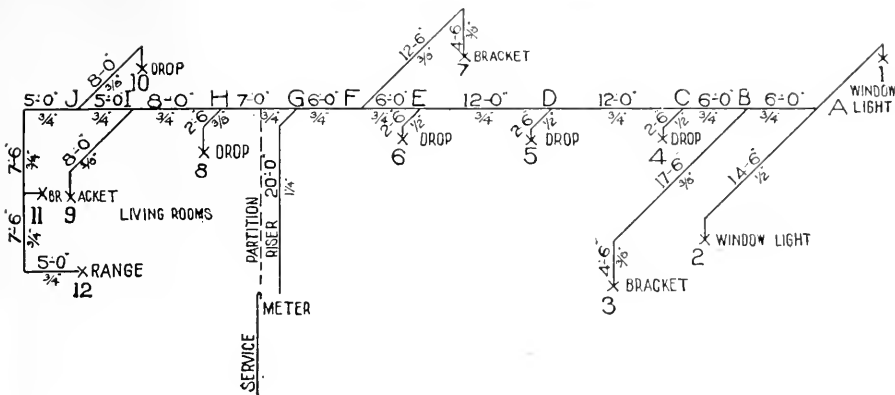
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SAMPLE PIPING PLAN STORE WITH LIVING ROOMS IN REAR



Plan No. 2. Store with Living Room in Rear.

Line	Number of 3/4-inch Equivalents supplied by line	Length	Size
K to J	5	12' 6"	3/4"
K to J	6	12' 6"	3/4"
J to I	1	8'	3/4"
J to I	7	5'	3/4"
I to H	1	8'	3/4"
I to H	8	8'	3/4"
H to G	1	2' 6"	3/4"
H to G	9	7'	3/4"
G to F	2	14' 6"	1 1/2"
G to F	2	9' 6"	1 1/2"
F to E	4	6'	3/4"
F to E	1	2' 6"	3/4"
E to D	5	6'	3/4"
E to D	1	2' 6"	3/4"
D to C	6	12'	3/4"
D to C	1	2' 6"	3/4"
C to B	1	2' 6"	3/4"
C to B	6	12'	3/4"
B to A	1	2' 6"	3/4"
B to A	7	12'	3/4"
A to F	1	2' 6"	3/4"
A to F	8	6'	3/4"
G to F	1	17'	3/4"
G to F	12	6'	3/4"
G meter	21	20'	1 1/4"

METER AND RISERS AND THEIR LOCATION.

32. Location for Meter. The Company reserves the right to determine in all cases the location for the meter.

33. Location for Risers. All risers must be placed in public basements, provided the latter are dry and warm and not less than 6 feet in height. The Gas Company positively will not set a meter in a basement that is less than this height.

If no public basement or meter room is provided, the riser for each floor should be placed either in the toilet, pantry or kitchen of that floor.

34. Risers in Laundries, etc. Risers may be run to laundries, furnaces or boiler rooms, provided the risers are not placed closer than 10 feet to any appliance and in no case directly in front of a boiler or a furnace.

35. Riser for Theatre. A meter to supply a theatre may be set in a public meter room with other meters and may be supplied by the service supplying these meters.

36. Piping for Laundry Room. In a flat building where appliances, such as laundry stoves, driers, etc., are installed for the joint use of tenants, a pipe from each tenant's meter must be run to the laundry room and

the appliance. Each riser must be equipped with a lock-cock.

A meter tag with the flat number plainly marked thereon must be securely fastened to each cock.

One outlet for a light in the laundry may be taken from the end of the laundry header.

37. Riser in Cold Basement. A riser in an unheated basement should be located 4 feet from an outside wall. If, however, the owner desires the meter set on the outside wall, this will be permissible, provided a false partition of wood is built and an air space of 2 inches is left between the partition and the wall.

38. Vestibule Partition. A riser must not be run closer than one foot to a vestibule partition.

39. Electric Cut-off Box. A riser must never be brought to a point nearer than 5 feet from an electric cut-off box.

40. Riser in Other Apartment. A riser for one apartment must not end in another apartment, except as provided for in Rule No. 48.

41. Prohibited Locations for Risers. A riser must not end in any place where the Gas Company's meter will be exposed to frost or dampness, or liable to injury from any cause.

LOCATIONS SPECIFICALLY PROHIBITED.

Under a bulkhead or show-window.

Horse stall or any place in a barn where it would be at all liable to be disturbed by horses.

Sleeping apartment.

Stairway closet.

Bedroom closet.

Under a sink or washstand

Over a toilet stool.

In the way of a flush tank.

Over a gas or an electric light.

In a closet that is not properly ventilated by means of either a register or an opening close to the ceiling.

In a room where a moving picture machine is to be operated.

42. Riser in Front Hall. If the riser in an old building must end in the front hall, the pipe must not be run to a point nearer than 1 foot from the outside wall.

43. Height of Risers. A riser must be placed at a height of not less than:

1 foot from the floor for openings up to 60 in number.



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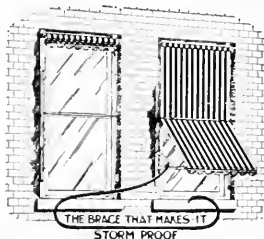
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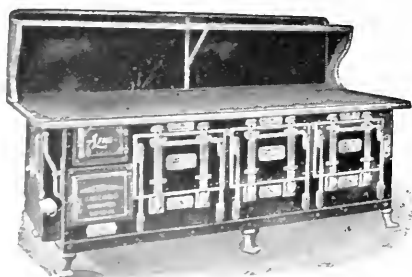
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5 feet from the floor for 60 to 100 openings.

6 feet from the floor for any number over 100 openings.

No riser must be placed higher than 9 feet from the floor.

44. Distance Below Ceiling. A riser must extend not less than 1½ inches below a finished ceiling, or 2 inches below an unfinished one.

45. Exit Lights. When running pipe for exit lights in theatres, schools, amusement or assembly halls, the city building ordinance should be referred to.

46. Light for the Top Floor. The top floor of a single building is considered a private hall, and, if desired, a light may be taken from the running line supplying that floor.

47. Public Lights—3-Flat Building. In a three-flat building or over, outlets for vestibule, public hall and basement lights must be taken from an independent pipe, and an opening left on the building service so that a separate meter can be set for these lights. If so desired, the riser may be connected with a union, or a right and left coupling to the meter of the applicant who may wish to pay for the gas.

48. Public Lights—2-Flat Building. In a two-flat building the outlets for the vestibule and basement lights must be taken from a separate riser, the end of which must be located near the first floor riser so that these outlets can be connected. A separate outlet in the building service for the vestibule and basement lights will not be required.

OUTLETS.

49. Outlet for Fuel. If the pipe has been run under the floor, the outlet for fuel in a kitchen must be left 3 inches above the floor and 2 inches clear of the baseboard. If the pipe has been run overhead and down, the outlet must be left 3 feet from the floor and 2 inches clear of the finished wall.

50. Drops. Drop outlets in a residence must be produced 1½ inches below an unfinished ceiling, or ¾ inch below a finished one. In a store the drop outlets must be produced 2¼ inches below an unfinished ceiling, and 1½ inches below a finished one.

51. Mantel or Fireplace. An outlet for a mantel or fireplace must be produced ½ inch above the finished bottom of the fireplace, 6 inches from the left hand side and 6 inches from the back.

BUILDING SERVICES.

52. Building Service Only. If it is desired to install a building service only in any building, instructions for size of pipe and openings to be left must be obtained from the General Office of the Gas Company.

The size of the building service must in every case be determined by the size and number of openings.

53. Building Service in Flat or Residence. A building service for a flat building, or a residence must be run overhead, and brought down in an inside partition, not less than 4 feet from an outside wall.

No building service must be run under a basement floor or under a first floor where there is no basement.

54. Building Service in Store. A building service in a store may be run overhead if the entire horizontal run of pipe can be graded to the street service. If not, it must be run under the floor.

When a building service is run overhead it must be brought down at least 4 feet from the front wall of the building.

55. Building Service Underground. When it is necessary to extend a building service underground from the front to the rear of a store or factory building, it must be encased in tile pipe with cemented joints.

56. Two Services in One Trench—Doorways. Where stores in one building are to be supplied with separate services, the building services for the adjoining stores must be brought as close together as possible. If two building services are within 4 feet of each other, the two street services will be run in one trench; if they are farther apart, two street openings will be required.

Building services may be run so that street service will come under doorway, provided the Gas Company is notified so that the service may be run before any mosaic, concrete or other floor is laid.

57. Building Service in Unheated Basement. A building service in an unheated basement must be graded to the street, and the tee left turned up so that any condensation forming in the pipe will run to the street and not to the meter.

58. Solid Wall Porch. In a building with a solid wall porch, the building service must be run to the front and then to the side wall.

59. Service Beyond Front Wall of Building. When there are one or more finished rooms in the front part of a basement and the owner does not wish to have the building service appear in these rooms, it may be terminated outside of them, but as close to the front of the building as the finished portion of the basement will permit.

The Company's service will be continued on the outside of the building to this point, provided it is not more than 50 feet from the lot line and provided that the pipe does not have to be laid in a space which is covered or to be immediately covered with cement.

60. Location of Building Service. When risers are located in the rear of a basement or in a room provided for that purpose, or on the various floors, the building service must be brought to within 18 inches of the wall through which the street service will be produced.

61. Wrapping Building Service. A building service run under an open porch and connecting the front and rear sections of a building, must be covered with mineral wool or steam pipe covering and boxed in.

62. Encasing Building Service. A building service laid through a masonry wall must be encased and the pipe left resting on the bottom of the casing with a 1½-inch clearance on top.

63. Opening in Building Service. The opening in a building service should always be on the left hand side of the riser which it is to supply, and 15 inches from it.

64. Test-pipe to Prove Work. Every building service must have a ¾-inch test-pipe to which a gauge can be attached.

65. Building Service Header. When it is necessary to set more than two meters together, a building service header must be supplied with an opening for each meter.

66. Services for Stores. A building containing stores must have a separate service for each store, unless a public meter room or other public place on the floor or below that where the gas is to be used is provided.

67. Services for Apartment Buildings. In apartment buildings of 12 flats and under, only one Company's service will be required. This will make it necessary to connect the various building services, supplying the groups of risers regardless of fire walls, and extend one building service to the point where the Company's service will come in.

In apartment buildings containing more than 12 flats, two or more Company's services will be allowed.

68. Services for Court Buildings. In a building which faces on a park-way or has a park-way or court in the center, the Gas Company will run one service in the court or park-way, and branch therefrom to supply the various building services.

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as well as plans for the remodeling of old buildings should include ample provision for *telephone wiring*. This is especially applicable to plans for hotels, apartment houses and office buildings.

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on such matters and will gladly offer suggestions to suit individual cases. This service may be the means of saving costly alterations after the construction work has been completed. It is furnished free of charge.

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State Engineer W.R. McGovern**

(See pages 229 and 231)

Chicago Telephone Company

The gas fitter may run building services through fire walls and connect them, but these must be extended as close to the front of the building as possible.

Any building service in a court building must not be terminated in a finished room.

69. Locating Service to Corner Building. To avoid complications when working on a corner building, the gas fitter should obtain from the Gas Company a written notice giving the exact location where the Company's service will enter the building.

70. Building in Rear of Corner Lot. A building on the rear of a corner lot must be supplied from the side street if a gas main is on that street. If not, it may be supplied either from the front building or directly from the main, whichever is the more practicable.

71. Building in Rear of Lot. When a building in the rear of a lot is to be supplied, a separate service should be used wherever possible. If, however, an independent supply is not practicable, the building service for the front building, if there is one, must be extended to the rear of the building, and of a size not less than 1½ inches so the rear building can be supplied from it also.

In all cases where a supply to a rear building is desired the Gas Company must be consulted.

72. Opening in Wall for Service. In a new building, an opening should be provided in the wall for the Gas Company's service. The most preferable way is to build a sleeve of wood, rectangular in shape, 12 inches by 5 inches, with an inside partition about 6 inches from the street end of the sleeve.

Application should be made to the General Office of the Gas Company to locate the wall and the point in the wall where in the sleeve should be built, so that when the service pipe is run, it will pass through the opening, provided therefor. In this way the damaging of foundation walls will be avoided.

73. Opening in Floor for Service. When a service connection may have to be made above the floor level, an opening must be left in the floor so that the street service can be introduced without disturbing anything. The

Building Inspection department will, on notification, instruct the gas fitter where to leave this opening.

74. Bringing Building Service to Street Service. When the Company's service is into a building before the house-piping is completed, the building service must be brought directly over the street service, except where the Company's service comes through the bay, then the building service must be brought to the nearest corner of the bay.

75. Terminating Building Service. A building service must not be terminated in a coal hole or in any other place where it will not be easily accessible.

WORK DONE BY THE GAS COMPANY.

76. Work Reserved. This Company does not permit anyone but its own authorized employees to place any piping or connections on any part of either the outlet or inlet meter connections, turn on the gas, disconnect, move, or interfere in any way with its piping, meters or connections.

77. Instructions. If a meter is connected and the customer desires alterations in the house-piping which would necessitate the disconnecting and reconnecting of the meter, or service, or both, he should be directed to telephone to the General Office of the Gas Company, 128 S. Michigan Blvd.

78. Changing Location of Meter. If a customer wishes to have the location of the meter changed and will have the necessary piping installed, the Gas Company will reset the meter and reconnect the service without charge.

79. Work Done Free of Charge. If alterations in house-piping caused by the remodeling of building mean an increase in the consumption of gas, the Gas Company will change the location of the service or reconnect, free of charge, but under the service rules for paying, excess pipe, etc.

Increase of consumption must be indicated by the need of a meter of a larger capacity or an increase in the number of meters.

80. Work Charged For. If alterations in house-piping due to remodeling in building do not mean an increase of consumption the cost of changing the location of or reconnecting the service must be paid for by the customer.

SUGGESTIONS FOR THE PROVISIONS OF WIRING AND CABLING OF BUILDINGS FOR SERVICE OF CHICAGO TELEPHONE CO.

The extensive use of the telephone in office buildings, hotels and large apartment buildings renders it essential that a provision be made in all modern buildings of these types, in advance of their completion, for carrying the requisite number of wires necessary for furnishing telephone service.

Where a private branch exchange switchboard or a building basement terminal is installed it is necessary to carry at least two wires from each telephone to the central distributing point in the building. Where these buildings are furnished telephone service by means of cable it is generally necessary to extend a building cable and establish one or more branch terminals, from which the distributing wires are taken. Hence, the importance of making adequate provision in advance for such building cabling and wiring.

It is advisable to have such provision included in the building plans. Otherwise the walls may be disfigured by unsightly open wire runs, or it will be necessary to make openings through the walls, floors and partitions after the completion of the building.

The Telephone Company will be pleased

to furnish the owner or architect with all necessary information as to size, type and location of conduits. Building wiring may be logically divided as follows:

(1) APARTMENT BUILDINGS.

The term apartment buildings as used herein means buildings larger than single houses or stores and smaller than office buildings. Such buildings may contain living and office apartments, also stores, generally on the ground floor.

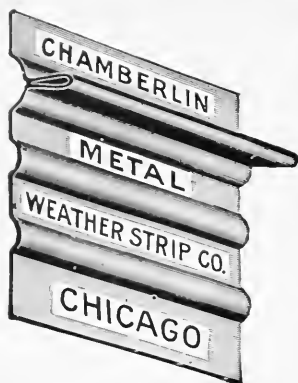
In an apartment building the maximum number of telephones in any one apartment, or on any floor, is quite definitely fixed, generally one per apartment.

Vertical building conduit, with an outlet at each floor, should be installed in each tier of apartments in an apartment building.

(2) OFFICE BUILDINGS.

The wiring of an office building presents a difficult problem for the following reasons:

The number of telephones will depend largely upon the character of the business and district. The number of telephones on any floor of these buildings will depend upon the requirements of the individual tenants.



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This is not constant for any extended period, as tenants may from time to time be replaced by others using more or less service.

In office buildings where the floor is likely to be divided into a large number of rooms or offices the distributing wires from the floor terminals to telephones can be run in moulding. The floor terminals should be located near the ceiling. A suitable moulding should be provided in the halls for carrying the wires from the terminal boxes to the various rooms. A smaller moulding should also be provided in the individual rooms, or suites of rooms, for carrying the wires to the proper location desired.

At certain intervals, depending upon the arrangement of the building in question, it will be desirable to have a piece of conduit extend across the ceiling of the hall in order to distribute from the floor terminal on one side of the hall to the rooms on the other side of the hall, in case there is no terminal on the other side.

With the system above described, the wiring is practically concealed and the system is flexible enough to allow proper distribution of facilities among the various rooms on the floor.

In large office buildings it is necessary to have a cross connecting rack—to afford means for getting connections between different floors. In the case of very large buildings a small room should be designed for this in the basement.

in either the office building class or the apartment building class or a part of both.

Where a very large use of telephones is contemplated, outlets may be placed in the floors on approximately five-foot centers, which outlets are connected to distributing centers by a lateral system of ducts or iron conduits.

The telephone system installed in hotel buildings consists of a telephone switchboard located at some convenient point, usually on the ground floor, in or near the office. Telephones are placed in each room or suite and wired to the switchboard, which is connected by one or more trunk lines with the nearest exchange of the Telephone Company. The wiring problem is, therefore, comparatively simple, involving the running of a pair of wires from some definite point in each room or suite to a common center near the switchboard location. Provision should also be made so that the Telephone Company can run its trunk wires from the switchboard to the point at which the telephone cable enters the building from the street, usually in the basement. A two (2) inch conduit is frequently sufficient for this purpose.

The method of getting wires from the common point (switchboard) up through and to the various floors, also the provision for terminating service cables, is the same as above described for cabling of office buildings.

From the floor terminal a conduit one-half ($\frac{1}{2}$) inch inside diameter is run to a designated location in the wall of each room in

Cable.	Conduit Twisted Pairs.	Conduit Straight Run Less than 75'.	Conduit Straight Run More than 75'.	Conduit Run One 90° Bend.	Conduit Run More than 75'. One 90° Bend.	Outside Diam. of Cable.	Size of Pull Boxes.
	2	$\frac{3}{4}$ "	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "		4"x4" 2" deep
	4	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "		6"x18" 4" deep
25-pr.		1"	1"	1"	1 $\frac{1}{4}$ "	23.32"	6"x20" 4" deep
50-pr.		1 $\frac{1}{4}$ "	1 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "	29.32"	6"x20" 4" deep
100-pr.		1 $\frac{1}{2}$ "	2"	2"	2"	1 3.15	8"x24" 6" deep
200-pr.		2 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	1 $\frac{3}{4}$ "	10"x30" 8" deep
300-pr.		3"	3"	3"	3"	2 1.16"	12"x32" 8" deep
400-pr.		3"	3"	3"	3"	2 $\frac{3}{8}$ "	12"x32" 8" deep
600-pr.		3 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "	2 $\frac{3}{4}$ "	12"x36" 10" deep

Conduits smaller than 1" are objectionable for lead covered cable because they are frequently deformed during construction of building.

All runs exceeding 100 feet in length
All runs having more than two 90° bends
All runs having bends sharper than 90° } should be provided with pull boxes.

When an entire office building, or several floors of a large building, is devoted exclusively to the purposes of one firm, some floors are generally not subdivided into small rooms, yet it is necessary to supply telephone service to many desks in the large rooms, and it is desirable to have the telephone wiring concealed.

If the room has columns and the desks can be grouped along the walls and about the columns, outlet boxes can be placed adjacent to these groups of desks and these outlets connected to distributing centers by iron conduits, as described under "Hotel" wiring.

Where a very large use of telephones is contemplated, outlets may be placed in the floors on approximately five-foot centers, which outlets are connected to distributing centers by a lateral system of ducts or iron conduits.

(3) HOTELS.

Depending upon the size and location, type and kind of building and character of service contracted for, a hotel may be included

which a telephone is to be placed. The height of the outlets in each room should be about five (5) feet from the finished floors; this will depend largely upon the desire of the hotel architect or owner. A one-half ($\frac{1}{2}$) inch (inside diameter) conduit should not be over fifty (50) feet in length, nor have more than three bends with a minimum radius of five (5) inches. Any conduit one hundred (100) feet in length should not be less than one (1) inch inside diameter. One-half ($\frac{1}{2}$) inch (inside diameter) conduit should be provided for a maximum of two pairs of wires; three-quarters ($\frac{3}{4}$) inch (inside diameter) conduit for five pairs; and one (1) inch (inside diameter) conduit for nine pairs. In extending conduit from terminal boxes to rooms it is possible in many cases to use one run of larger conduit to supply three or four rooms, rather than run smaller conduit to each individual room. When the floor area and the number of rooms are large it may be found economical to have more than one terminal box on a floor

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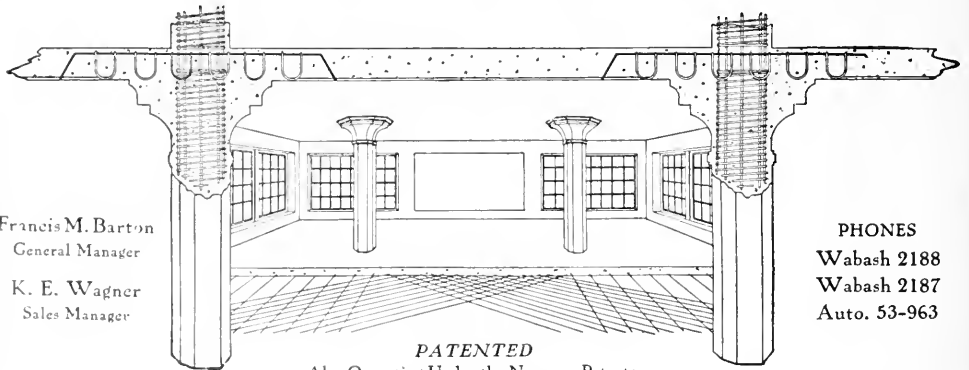
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FLAT SLAB CONSTRUCTION

UNDER CHICAGO MUNICIPAL REQUIREMENTS*

By Arthur R. Lord, B. S., M. S. C. E.

*The following data relating to flat-slab construction is given in order to indicate to Chicago architects the necessary floor thickness, etc., required by the Chicago ruling governing the design of this type of construction. The tables are primarily intended to enable an architect to show the slab thickness on his drawings and to work out in advance such details as are affected by this type of floor construction. The design or checking of a typical square panel is not difficult and the table is designed to be of great assistance in such work. But nearly every building involves many variations and special problems to the solution of which a wide experience in the design of this type of construction is almost indispensable.

The table is worked out for the more common "four-way" type of flat-slab construction. The total thickness through the depression will be the same for either "four-way" or "two-way" slabs but the thickness of the slab itself must be somewhat increased under the heavier loadings when two-way construction is used. Only the four-way table has been worked out here.

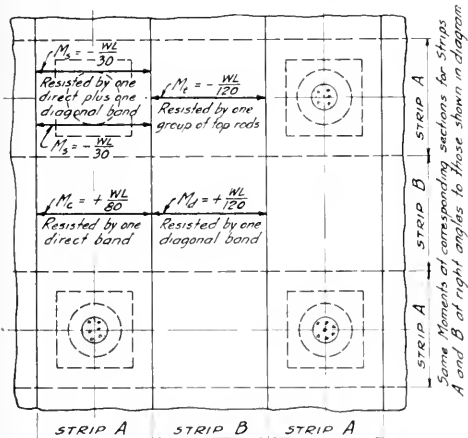


Fig. 1

The basis of calculation of flat-slabs under the Chicago ruling is illustrated in Fig. 1. The floor is divided (for design purposes) into strips one-half the panel in width. "Strip A" includes one row of columns and extends to the quarter point of the panel on either side. "Strip B" includes the half panel lying between Strips A.

The negative moment M_3 (See Fig. 1 and 2) over the column head on a right section of strip A is specified as $\frac{WL}{30}$ in which W

the total dead and live load on one panel and L the distance center to center of columns. (If L is taken in feet the moment will be in foot-pounds; if L is taken in inches

the moment will be in inch pounds.) This negative moment is resisted by the total reinforcement in one direct and one diagonal band over the column head.

The positive moment M_4 (See Fig. 1) midway between columns on Strip A is specified as $\frac{WL}{80}$ ($\frac{WL}{60}$ for two-way flat slabs.) And this is resisted by the reinforcement in one direct band at the center of the panel as seen from Fig. 1.

The positive moment M_2 (See Fig. 1) at the center of the panel on Strip B is specified as $\frac{WL}{120}$ and this is to be resisted by the reinforcement in one diagonal band at the center of the panel.

The negative moment M_1 (See Fig. 1) on a section on the column center line across strip B is specified as $\frac{WL}{120}$ and in the four-way

type this moment is resisted by a group of special rods located in the top of the slab in Strip B. These "top rods" extend to the quarter point of the panel on either side of the column center line.

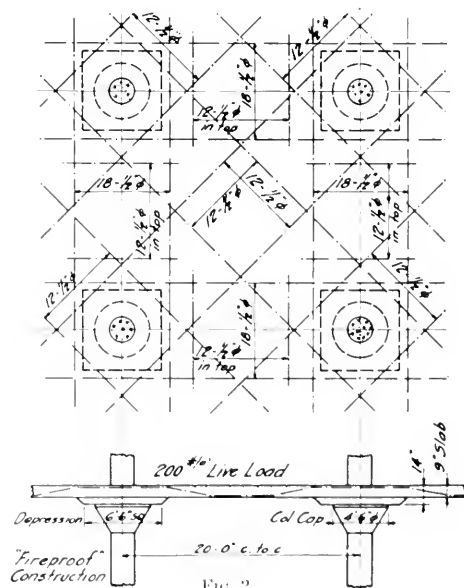


Fig. 2

The Chicago Ruling (in accordance with the observed distribution of moments and stresses in extensometer tests of flat-slab floors) specifies a much greater moment over

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the column head than at the center under all conditions of load. As a result the "depressed panel" (a thickening of the slab around the column capital) is the economical design and this type is in all but universal use in the country today. The use of the depressed head considerably reduces both the dead weight of the floor and the amount of steel and concrete required to build it. The table (following general practice) is confined to the "depressed panel" type of four-way flat-slab construction. Fig. 1 and 2 shows the depressed panel clearly. The thickness of depressed panel depends upon its size and is figured from the negative bending moment WL

— at the column head. The sizes ordinarily used range from .3L square to .4L square. The table is figured for a .325L square depressed panel in all cases. If a larger size were used the depressed panel could be made thinner, of course.

Chicago Ruling specifies a minimum slab thickness computed from the following formula:

$$t = .023 L_s / W$$

in which t = thickness of slab between depressions.

L_s = span c. to c. of columns in feet.
 W = total dead and live load per sq. ft. of floor.

The diameter of the column capital (whether round, square or octagonal) must be not less than $0.225 L_s$ (4'-6" for a 20-foot square panel).

It is not always advisable to use the exact slab thicknesses as figured by the regulations. Experience indicates various modifications and the thicknesses stated in the table are so derived in some cases. The balancing of steel areas between negative and positive moment requirements will also dictate the economic slab thickness in some cases. It is not our problem here, however, to go into the requirements of expert design since our purpose is primarily to provide architects with a basis for checking Chicago flat-slab designs.

EXAMPLE OF USE OF TABLE AND FORMULAE.

Fig. 2 represents a design of a flat-slab floor in "fireproof" construction represented to be in accord with the Chicago Ruling, and which the architect desires to check. In the table opposite 200lb Live Load and 20-foot panel we find that an $8\frac{1}{2}$ " slab and a $13\frac{1}{2}$ " total thickness should be provided with a 6'-6" square depression. "Fireproof" construction, however, requires one-half-inch more of covering and hence the slab thickness of 9" and total thickness of 14" shown on the drawing are correct. (The slab might be thicker, but should not be thinner than the tabulated values.) The concrete is therefore all right.

To check the steel reinforcement we must compute the bending moments as indicated in Fig. 1. In Fig. 2 1'-20", W —122000lb (from table) plus 100x6 2400lb for additional fireproofing—124400lb.

$$WL = 124400 \times 20$$

$$\therefore M_s = \frac{124400 \times 20}{30} = 83066\frac{2}{3} \text{ lb} = 996000\frac{1}{3} \text{ lb}$$

To find d at the support we must subtract from the total thickness of 14", one inch for fireproofing, one inch for two layers of one-half inch rods and one-fourth inch for the "lift" of the bars (bars will not pack absolutely tight).

$$\therefore d = 14" - 2.25" = 11.75"$$

Assuming medium steel the allowable steel stress will be 16000-lb./sq.", and the required cross sectional area of all bars in one direct and one diagonal band over the column head must be not less than

$$A_s = \frac{996000}{16000 \times 875 \times 11.75} = 6.06 \text{ sq. ins.} = 31, \frac{1}{2} \text{ "o.}$$

Over the column Fig. 2 shows 18, $\frac{1}{2}$ "o rods in direct band and 12, $\frac{1}{2}$ "o rods in diagonal band, a total of 30, $\frac{1}{2}$ "o rods for one direct band and one diagonal band. One additional rod must therefore be supplied over the column head.

$$M_e \text{ (see Fig. 1)} = \frac{WL}{80} = \frac{124400 \times 20}{80} = 31200\frac{1}{2} \text{ lb}$$

$$= 37400\frac{1}{2} \text{ lb}$$

d for this direct band—9" slab less 1" fireproofing less $\frac{1}{2}$ " to center of rod—7.5". The required cross sectional area of steel in direct band at center is therefore

$$A_s = \frac{37400}{16000 \times 875 \times 7.5} = 3.56 \text{ sq. in.} = 18, \frac{1}{2} \text{ "o rods, same as the amount provided in Fig. 2.}$$

$$M_d \text{ (See Fig. 1)} = \frac{WL}{120} = \frac{124400 \times 20}{120}$$

$$= 20750\frac{1}{2} \text{ lb} = 249000\frac{1}{2} \text{ lb}$$

d for the diagonal bands—9" slab less 1" fireproofing less $\frac{5}{8}$ " to center of two layers of steel—7.38". The required steel area in each diagonal band is therefore

$$A_s = \frac{249000}{16000 \times 875 \times 7.38} = 2.41 \text{ sq. ins.} = 13, \frac{1}{2} \text{ "o rods in place of the 12, } \frac{1}{2} \text{ "o rods shown in Fig. 2.}$$

By adding one rod to the diagonal band the deficiency in the steel over the column head is also made up.

$$M_t \text{ (See Fig. 1)} = \frac{WL}{120} = 219000\frac{1}{2} \text{ lb.}$$

d for the top rods—9" slab less 1" fireproofing less $\frac{1}{4}$ " to center of rod—7.75". The required steel area in each group of top is therefore

$$A_s = \frac{219000}{16000 \times 875 \times 7.75} = 2.3 \text{ sq. in.} = 12, \frac{1}{2} \text{ "o rods same as provided in Fig. 2.}$$

The only change necessary to bring this design up to Chicago ruling is the addition of one rod to each diagonal band.

For wall panels Chicago ruling specifies moments 20% higher where wall columns are used and 50% higher where the slab rests on brick walls at the edges—the increase applying to moments at center of wall panel and also at interior column heads next to wall panels. The general method of checking is the same as that exemplified above.

For rectangular panels, the slab thickness and the steel in diagonal bands at the center of the span will be same as in a square panel of the same average dimension. In a 20'x24' panel, for instance, the slab thickness and diagonal band will be the same as for a 22' square panel. The direct band on the 24' side of the panel will be the same as the direct band in a panel 24' square while the direct band on the 20' side will be the same as the direct band in a 20' square panel. This way of stating the Chicago provisions for rectangular panels (ruling says steel is to vary as ratio of cubes) greatly simplifies the checking of designs.

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I. C. R. R.**

(1) Safe Live Load	(2) Side of square panel L	(3) Total load on one panel W	(4) Diam. of column capital C	(5) Side of square depression b.	(6) Slab thickness Through depression	(7) Slab only.	(8) Dead Weight of slab.	(9) Cu. ft. of Concrete per sq. ft.
#/sq. ft.	Ft. Ins.	Lbs.	Ft. Ins.	Ft. Ins.	Inches.	Inches.	#/sq. ft.	Cu. ft.
35	16-0	29500	3-8	5-3	9.5	6.0	80.0	0.531
100	do	46100	do	do	9.5	6.0	80.0	0.531
150	do	58900	do	do	9.5	6.0	80.0	0.531
200	do	73400	do	do	10.5	6.5	86.5	0.577
250	do	88000	do	do	11.5	7.0	93.5	0.623
300	do	102800	do	do	12.5	7.5	100.5	0.669
35	17-0	33200	3-10	5-6	9.5	6.0	80.0	0.531
100	do	53800	do	do	10.0	6.5	86.0	0.572
150	do	68200	do	do	10.0	6.5	86.0	0.572
200	do	82600	do	do	10.5	6.5	86.0	0.574
250	do	100000	do	do	11.5	7.25	96.0	0.641
300	do	117500	do	do	13.0	8.0	106.5	0.710
35	18-0	38200	4-1	5-10	9.75	6.25	83.0	0.551
100	do	62500	do	do	11.0	7.0	93.0	0.618
150	do	78900	do	do	11.5	7.0	93.5	0.623
200	do	95000	do	do	11.5	7.0	93.5	0.623
250	do	115200	do	do	12.5	8.0	106.0	0.706
300	do	133900	do	do	13.5	8.5	113.0	0.752
35	19-0	43700	4-3	6-2	10.0	6.5	86.0	0.572
100	do	70800	do	do	11.0	7.25	96.0	0.638
150	do	88900	do	do	11.0	7.25	96.0	0.638
200	do	107900	do	do	11.5	7.5	99.0	0.660
250	do	131000	do	do	13.5	8.5	113.0	0.752
300	do	151100	do	do	14.0	9.0	119.0	0.794
35	20-0	51200	4-6	6-6	11.25	7.0	93.0	0.621
100	do	80000	do	do	12.0	7.5	100.0	0.665
150	do	100000	do	do	12.0	7.5	100.0	0.665
200	do	122400	do	do	12.5	8.0	106.0	0.706
250	do	147200	do	do	14.0	9.0	118.0	0.788
300	do	170500	do	do	15.0	9.5	126.0	0.840
35	21-0	57800	4-9	6-10	11.5	7.25	96.0	0.641
100	do	91000	do	do	12.5	8.0	106.0	0.706
150	do	113000	do	do	12.5	8.0	106.0	0.706
200	do	138100	do	do	13.5	8.5	113.0	0.752
250	do	166000	do	do	15.0	9.5	126.0	0.837
300	do	191100	do	do	16.0	10.0	133.0	0.886
35	22-0	64000	4-11	7-2	12.0	7.5	100.0	0.665
100	do	101000	do	do	13.5	8.5	113.0	0.752
150	do	124600	do	do	13.5	8.5	113.0	0.752
200	do	151000	do	do	14.0	9.0	119.0	0.794
250	do	181300	do	do	16.0	10.0	133.0	0.886
300	do	208300	do	do	17.0	10.5	140.0	0.932
35	23-0	74600	5-2	7-6	12.5	8.0	106.0	0.707
100	do	114300	do	do	13.75	8.75	116.0	0.774
150	do	141200	do	do	14.25	8.75	117.0	0.778
200	do	172600	do	do	15.0	9.5	126.0	0.841
250	do	206200	do	do	17.0	10.5	140.0	0.932
300	do	236300	do	do	17.75	11.0	146.5	0.977
35	24-0	83500	5-5	7-10	13.5	8.25	110.0	0.734
100	do	126300	do	do	14.5	9.0	119.5	0.798
150	do	155000	do	do	14.5	9.0	119.5	0.798
200	do	192000	do	do	16.5	10.0	133.5	0.890
250	do	238200	do	do	17.5	11.0	146.0	0.974
300	do	261600	do	do	19.0	11.5	151.0	1.021

Note—This table is figured for fire proofing over all reinforcing steel one-half inch thick—ordinary concrete construction under the Chicago ordinance. For "fire proof" construction add one-half inch to slab thicknesses given in table columns (6) and (7) and add six lbs. per sq. ft. to dead weight of slab, column (9), increasing total panel load, column (3), to correspond.

*Note—While the "Flat Slab Type" of construction is controlled under the "Norcross patents" its use has become so general that we do not hesitate to include a general discussion of this subject from a technical standpoint in our text matter. We do so purely as a matter of information on a subject in which we believe our constituents are vitally interested. We do not in so doing express any advocacy of any special system except in so far as economy and efficiency shall dictate. We are on record, now and always, as insisting that no system or type of con-

struction should be adopted by any architect for any portion of his client's work unless he is convinced from careful independent research that same will secure for his client the best return for the money invested.

There are a considerable number of more or less divergent applications of these general principles which are presented by various contracting engineers and dealers in diversified types of reinforcing material. We believe, however, that there is nothing in the policy of the owners of these patents that prevents the architect or the independent consulting structural engineer from adopting flat slab principles in design, provided he is convinced that there is sufficient additional economy or value (inconvenience of arrangement to justify his client's paying to the Flat Slab Patents Co., directly or indirectly, the uniform royalty which they charge, as owners of the basic patents, to all users of same.

Editor.

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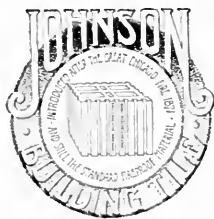
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SPECIFICATIONS FOR STANDARD HOLLOW TILE FIREPROOFING

General: The Contractor for this work will be required to furnish all of the material and labor of every description required to erect the same in place complete. The Contractor is referred to the plans and details for the general construction, and especially the steel diagrams and details showing connection between the structural steel and tile work.

Special Shapes: The Contractor shall furnish all necessary special shapes for the proper fitting to the steel work.

Details: When requested to do so the Contractor shall furnish large scale details or full sized drawings for all special shapes, column coverings, lintel covers, girder covers, and general type of arch, which shall be submitted to the Architects for their approval.

Scaffolding, Tools, etc.: Furnish all the tools, machinery, hoisting apparatus and centering necessary to carry on the work at the rate of progress stipulated in the contract.

Tile: All the tile required for this work shall be of the best quality of hard burned fire clay, semi-porous, or porous terra cotta. This tile to be well manufactured, no badly split, cracked or warped tile will be permitted to go into the work.

Mortar and Laying: All tile work shall be laid in mortar composed of one part Portland Cement of an approved brand and four parts clean sharp sand, thoroughly mixed together dry and sufficient water added to wet to the proper consistency and then tempered with lime putty to make it work smooth. No more mortar shall be mixed at one time than can be used immediately. All tile must be laid with full flush joints, plumb to a line with horizontal beds uniformly level on each course. Fill all the joints, clicks and crevices between the tile and steel work with mortar well slushed in.

Type of Arch: The arches for the floors in general shall be — inch; flat or segment arches, with side or end construction. Skew-backs carefully bedded in place against beams.

Beam Tile: The soffits of all beams to be protected with slabs of tile at least 2 inches in thickness, with an air space at least $\frac{3}{4}$ of an inch by the width of the metal surface to be covered.

Roofs: The arches for the main roof are to be — in segment or flat arches same as specified for the floors.

Minor Roofs: The roofs of pent houses, roof over projecting portion in second story, floor of bulkheads, and other portions indicated on details as book-tile shall be made of Three-inch book-tile set in place between tee irons. Tee irons to be furnished by the iron Contractor.

Partitions: All partitions shown on plans to be built of the thickness indicated in figures. Partition walls to be built straight, true, plumb and well bonded with proper "breakjoint" bond on each alternate course and all joints thoroughly flushed up with mortar, and to be well wedged underneath.

Hollow tile used for building primary bearing walls, which are defined as walls that may be used to receive directly the loads from floors or roofs in addition to their acting as bearing partitions, must have a thickness of at least one-fifteenth the free height between floors and the load including the weight of the construction must not exceed 350 lbs. per sq. in. of net sectional area of the tile in compression.

Furring Tile: Where indicated on plans 2 inch furring tile are to be built against

the outside walls of the building. These tiles are to be secured to the brick walls with 10d spikes on every third course, driven into the brickwork at intervals not greater than 48 inches apart.

Curb Walls: The curb walls in basement shall be furred with three inch tile extending up to the under side of the iron plate along edge of curb walls and properly fitting around all beams.

Rough Frames and Blocks: The Contractor for carpenter work will furnish and erect the rough wood frames at all openings in partitions and furring. He will also furnish all wooden blocks necessary to form nailing facilities for attaching plaster grounds, etc. These blocks must be built in place by fireproofing contractor wherever directed by the Architect.

Column Covering: All column covering, shall start in all cases, directly from the tile arches of floor, column covering shall be designed to properly fit the columns and shall be secured by winding No. 12 gauge galvanized wire around the columns after the tile has been set around such columns. The wire shall be wound around the tile in such a manner that every tile is crossed at least once by a wire.

Covering Exposed Steel Work: All girders, beams, channels, etc., that show below the under side of ceilings, are to be encased on all sides with at least 2 inches thickness of fireproofing tile, so applied as to be supported entirely by the girders or beams protected.

Boxes for Plumbing Pipes: All soil, vent, down spout and water supply pipes shall be boxed in, using three inch tile, starting from the floor tile in all cases. This boxing shall not be done until the pipes have been properly tested, and covered by another contractor. There shall be no openings into boxes except for outlets on the various floors. Where these outlets occur small wood frames furnished by carpenter shall be set by the fireproofing contractor.

Bulkheads: All bulkheads of first and second floors shall be built of three inch tile, the structural iron contractor furnishing all necessary tee irons for the support of the tile. See details for bulkhead treatment, and iron drawings for the support.

Provide three inch tile for the ends of bulkheads where intersected by the entrance doors.

Toilet Room Floors: All toilet room floors where shown on plans shall be raised approximately one foot with fireproofing, supports to be so arranged as not to interfere with the piping of these rooms.

Pent Houses: The contractor shall build the walls of pent houses with four inch hard or glazed tile, laid up in Portland cement mortar, all joints to be thoroughly flushed up.

Curbs of all skylights shall be built of four inch tile.

Floor Strips and Concrete Filling: After the floor arches have been set in place, and at such time as may be designated by the architect, the contractor for carpenter's work will furnish and set the 2x3 inch wood floor strips required as nailing ground for the finished wood flooring, where wooden flooring is called for.

After the strips have been set, the fireproofing contractor must fill in between the same with concrete filling; this concrete is to be composed of one part American Portland cement, of approved brand, two parts sharp sand, and six parts broken tile, stone, gravel, or fine, clean coal cinders, thoroughly

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mixed together dry, then tempered and mixed and tamped in place. In no case shall cinder concrete be allowed to come in contact with structural steel.

Tile Blocking and Filling Between Floor Strips: For all wood floors on top of tile arch construction throughout the building lay on top of the tile arches, lines of tile of special die to receive the wood floor strips. The tile shall have a width on top equal to the width of the floor strip at the bottom and shall be leveled on both sides in continuation of the level of the wood strips.

After the wood strips are in place the spaces between them shall be filled with 2" special tile formed so as to firmly wedge them in place, the upper surface of the tile being $\frac{1}{4}$ of an inch below top of sleepers, all in accordance with detail.

Finally: Do everything necessary to finish the entire work in a thorough and substantial manner in strict accord with building laws and ordinances locally applicable. Remove promptly from the premises all the tools, scaffolding, unused tile, debris, etc., as soon as each portion is completed, so as to maintain all portions of the premises as free from obstruction as practicable.

RULES OF MEASUREMENT FOR EXCAVATION AND CONCRETE WORK.

The following rules have been carefully studied and analyzed by a joint committee consisting of five (5) members of the Chicago Architects Business Association, five (5) members of the Western Society of Engineers, and five (5) members of the Contractors' and Masons' Association of Chicago.

If any new rules or new applications of old rules should be found in the following, we can only say for their recommendation that we have carefully considered them in all their bearings, endeavoring to secure equal justice to owner as well as contractor, and that they will form the standard for deductions as well as for compensation for extra work.

EXCAVATION OF CELLARS AND BASEMENTS.

1. Excavation to be measured and computed by the actual amount of material displaced. If unit price is based upon loose measurement add forty (40%) per cent to actual bank measurement, except if consisting of sand and gravel, when only twenty (20%) per cent will be added. If rehandling becomes necessary, same to be done at a special price agreed upon in addition to the above.

EXCAVATION OF TRENCHES AND PITS.

2. Excavation of trenches, pier holes, or pits when more than 3' wide to be computed on actual contents when less than five (5') ft. deep.

When less than three feet wide excavation of trenches, pier holes, or pits to be computed on actual contents if less than two (2') feet deep.

If more than two feet (2') deep compute contents of trench on base of three foot (3') width, even though same is narrower.

If less than two (2') feet in depth estimate actual width.

For pits or pier holes more than two (2') feet deep and less than twelve (12) square feet in area estimate area of same on base of twelve (12) square feet multiplied by depth of same down to five (5') foot, and if more than five (5') feet deep estimate on same basis as given below for additional depth of trenches, with the same percentages of increases added.

Add 75% to actual contents of excavation of trenches, pier holes, or pits for depth between five (5') ft. to ten (10') ft.

Add 150% to actual contents of excavation of trenches, pier-holes, or pits, for depth between ten (10') ft. and fifteen (15') feet.

Add 225% to actual contents of excavation of trenches, pier holes, or pits for depth between fifteen (15') feet and twenty (20') feet.

Add 300% to actual contents of excavation of trenches, pier holes, or pits for depth between twenty (20') feet and twenty-five (25') feet.

Add 375% to actual contents of excavation of trenches, pier holes, or pits between twenty-five (25') feet and thirty (30') feet in depth.

Add 450% to actual contents of excavation of trenches, pier holes, or pits between thirty (30') feet and thirty-five (35') feet in depth, and so on, adding 75% accumulative for every five (5') feet additional depth.

BACK FILLING AND GRADING.

3. Soil required for back filling or grading to be measured by computing from cross-sectioning cubic contents of area to be filled or graded.

SHEET PILING.

4. Sheet piling and lagging to be estimated per thousand feet of lumber required. Kind of lumber to be specified.

SHORING OF EARTH BANKS.

5. Shoring of earth banks to be done at unit price, per square foot of shored surface of bank.

DRAINING.

6. Pumping or bailing when required to be done at special price, in addition to excavation unit price, as the excavation rules are based on dry work; this, however, does not apply to rain or storm water.

CONCRETE FOUNDATIONS.

7. Foundations for walls to be measured actual contents when made with square and level off-sets.

Footings with sloping or beveled off-sets less than 30% from the horizontal multiply area of base by greatest height of footing. This applies to piers also, except when courses in pier foundations are less than twelve (12') feet in area, when one (1) cubic foot will be added for each corner for every foot in height of such course.

8. Foundations for all projections such as chimney breasts, pilasters, buttresses, or flues connected with walls to be measured actual contents contained therein, and one cubic foot added thereto for each corner for every foot in height.

9. Recesses and slots in foundations to be measured solid and in addition thereto allow two (2) cubic feet for every foot in height or length.

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10. Arches in foundation. Multiply length of chord at spring of arch by height from chord to extrados by thickness of arch, and add to the wall measurement. Height of arching equal to thickness of wall.

CIRCULAR OR POLYGON FOUNDATIONS.

11. Circular or polygon foundations to be figured at double actual contents.

EXTERNAL, DIVISION AND INTERIOR CONCRETE WALLS.

12. For walls fourteen (14) feet or less in height, twenty-four (24) inches or more in thickness, use the actual thickness as basis in computing the volume. For walls less than twenty-four (24) inches in thickness, add one-half the difference between the actual thickness and twenty-four (24) inches in computing the volume. If walls are more than fourteen (14) feet in height between floors add to cubic contents fifteen (15) per cent for every additional four (4) feet in height, on accumulative scale, as given for trench excavation.

CIRCULAR WALLS.

13. For circular walls of radius sufficiently large to obviate the necessity of using specially prepared lumber for forms, add one-fifth (1-5) of length to girth of wall, and figure cubic contents on the same basis as prescribed for External and Division Walls, Paragraph 12.

BATTERED WALLS.

14. For battered, or sloping walls estimate contents on same basis as for external and division walls, and add one-half ($\frac{1}{2}$) of contents of wedge, or batter to same when narrower on top than twenty-four (24") inches. See Paragraphs 12 and 17.

INTERSECTION OF WALLS.

Intersection of division walls twenty-four (24) inches thick or less (bonded together in any manner not abutting) to be measured as slot or recess. When thicker add (1) one foot to length of wall for every intersection when measuring.

RETAINING WALLS.

15. In retaining walls reinforced with beams, columns, or girders figure concrete casing a minimum thickness of twelve (12") inches from outside edge of steel on side next to earth bank and six (6") inches from outside edge of steel on opposite side—i. e. compute wall one foot, six inches (1'-6") thicker than width of steel.

For all other retaining walls compute on same basis as for external or internal walls, paragraphs twelve (12) and seventeen (17.)

No deduction in cubic contents of concrete to be made for metal imbedded in same.

HOLLOW WALLS.

16. Hollow walls to be at special rates.

CORNERS.

17. For each corner of wall more or less than ninety (90) degrees add one foot, six inches (1'-6") to girth length of walls in measuring.

The term corner is used for salient angles of walls, and angle for re-entering angles.

PILASTERS, ETC.

18. All plain projections, such as chimney breasts, piers connected with walls and pilasters to be measured actual contents contained therein, and one (1) cubic foot added for each corner for every foot in height.

PIERS.

19. Independent plain square piers to be measured by the same rule, i. e. add one cubic foot for each corner for every foot in height. For plain polygon or round piers, add four (4) cubic feet for each foot in height.

RECESSES.

20. Recesses and slots to be measured solid and in addition thereto allow two (2) cubic feet for every foot in height or length.

ARCHES.

21. In Vaults: multiply length of chord at spring of arch by height from chord to extrados by thickness of arch.

In walls: find contents of arch by same rule and add same to wall measurement, as called for in paragraph ten (10).

In sewers and tunnel arches: multiply length of extrados by thickness of arch.

OPENINGS WITH FRAMES BUILT IN.

22. Deduct contents of windows, doors and other openings, measuring from jamb to jamb and from top of sill to spring of arch, and add two (2) feet of wall for each jamb for every foot in height of opening when plank frames are used; if box frames are used add four (4) feet of wall for each jamb for every foot in height.

OPENINGS WITHOUT FRAMES.

23. Deduct contents of openings, same to be measured from top of sill to spring of arch and shortest distance between concrete jambs for width, and add for each jamb two (2) feet of wall for every foot in height of opening.

Circular, oval or other special shaped openings to be figured at special price.

CHIMNEY BREASTS, FLUES AND PILASTERS.

24. All flues and hollows in chimneys or walls less than two (2) feet in area, figure solid and add two (2) cubic feet for every foot in height. All flues and hollows in chimneys or walls from two (2) feet to four (4) feet in area to be measured solid. When larger, deduct one-half ($\frac{1}{2}$) of contents of flue.

Detached portions of chimneys in buildings and plain chimney tops above roof to be measured solid, and one (1) cubic foot to be added for each corner for every foot in height.

DETACHED STACKS.

25. Detached chimney stacks to be figured at special rates.

TRIMMINGS.

26. No deductions allowed for omissions of concrete for cut-stone, terra cotta or other trimmings, bond blocks, timber, joists or lintels.

All ornamental or moulded work in cornices, gutters, belt or sill courses, etc., to be figured at special rates.

CUTTING AND PATCHING.

27. Cutting and patching of joists, girders, or other holes, slots, panels, recesses, etc., to be paid for on basis of time and material required.

TOOTHING.

28. When ordered by the Owner, Architect, Engineer, or the Superintendent in charge of the work, to rack or block in consequence of delay of delivery of iron, steel, stone, terra cotta, or other material, that concrete work may connect with such rack-

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ing or blocking shall be measured as extra work, as follows: Increase girt length of such line by one-half ($\frac{1}{2}$) and multiply by thickness of wall.

CONCRETE FLOORS ON SOIL AND TILE ARCHES.

29. Floors to be measured by the superficial surface between outside walls of building. No deduction to be made for floor sleepers, conduits, pipes, drains, division or partition walls. No deduction to be made for any piers, columns, chimney breasts, pilasters or other projections of walls of ten (10') feet or less in area.

CAISSONS.

30. Owing to grillage in caissons being left at different heights in same building, unit price for caissons will be computed on excavated contents, including necessary wood-lagging and rings for same. Cubic contents of excavation of caissons to be computed from top of first set of lagging to bottom of caissons and from outside to outside of lagging. If steel or other special casing is required same to be paid for additional, at special unit price per pound.

BELLS.

31. Area of bottom of bell to be multiplied by height of bell to neck for cubic contents.

32. For Caissons 7' 0" or more in diameter estimate actual contents from outside to outside of lagging.

For Caissons from seven to six ft. six inches inclusive add 5% to actual contents.

For Caissons under six feet six inches to six feet inclusive, add 15% to actual contents.

For Caissons under six feet to five feet six inches inclusive, add 25% to actual contents.

For Caissons under five feet six inches to five feet inclusive, add 35% to actual contents.

For Caissons under five feet add fifty per cent (50%) to actual contents.

33a. If compressed air is required, same to be paid for in addition to the above.

33. If rings are ordered left in caissons, same to be paid for additional at unit price per pound.

34. Pumping and bulkheading to be paid for at additional price.

35. No deduction to be made for cubic contents of metal imbedded in concrete.

CONCRETE FILLING IN CAISSONS.

36. Concrete for filling of caissons to be computed on actual contents per cubic foot of concrete, but no deduction to be made for any metal imbedded in same.

REINFORCED CONCRETE WORK.

37. Reinforced Walls:

Compute concrete on same basis as specified in Sections 12 and 17, for external and division walls, and add to same cost of reinforcing metal put in place. If through changes or revisions cutting of reinforcing metal delivered or ordered becomes necessary, estimate the full length of such bars or metal fabric, and add to same cost of cutting and fitting required. Reinforcing metal to be computed on unit price per pound or square foot. No deductions to be made in estimating cubic contents of concrete for any metal imbedded in same, such as wire netting, expanded metal, bars, beams, columns, etc.

COLUMNS.

38. Measuring of plain uniform size columns to be covered by the foregoing paragraph 19 relating to piers.

39. Capitals, caps, brackets, panels, mouldings or other ornamental or moulded work to be figured special rate.

GIRDERS, FLOOR BEAMS OR OTHER DROP PROJECTIONS BELOW FLOOR SLAB.

40. For projections named in this paragraph add for each corner and angle to cubic contents one (1) cubic foot for each foot in length. For each chamfered or rounded corner or angle add one-half ($\frac{1}{2}$) cubic foot for each foot in length in addition to the above.

FLOOR SLABS.

41. Floor and roof slabs to be estimated on same basis as called for in paragraph 29 for floors on soil, and at a minimum thickness of six (6) inches. Less than six (6) inches in thickness will be computed as six (6) inches

OPENINGS.

42. No deductions to be made in floor area for openings of less than twenty (20) square feet. For larger openings after deducting full area of opening, add one (1) superficial foot to floor area for each foot in length of girt of opening, and one (1) CUBIC FOOT extra for each corner or angle.

DEPRESSIONS.

43. For pits, baskets or other depressions in floor, add on superficial foot to the area of walls and floor of same for each foot in length of each corner and angle.

SETTING OF FACIAS, FRAMES, PIPES, SLEEVES, BOLTS, RODS, CLAMPS, ETC.

44. Setting of facias, frames, pipes, sleeves, bolts, rods, clamps, etc., imbedded in concrete to be paid for additional at special price.

FLOOR BASE AND COVES.

45. Floor base and coves to be estimated at special price per lineal ft. with one foot added to length of same for each corner and angle. For base or cove around round columns estimate three (3) times girt of column and for square or polygon columns add one foot for each corner to girt of same.

46. Concrete stairs to be estimated square foot area of face of treads and risers. Stair-landings and platforms between floors to be same unit price per foot as stairs.

47. Curbs and roofs or skylights to be estimated on same basis as called for in sections 40 and 41 except that quantities for same shall be doubled.

48. Sidewalks laid on soil or tile and brick arches, to be estimated as floor-slab section 29 with special unit price.

Sidewalks reinforced to be estimated same as called for in sections 40 and 41 with special unit price.

Curbs to be estimated per lineal foot at special unit price.

Driveways to be estimated square foot area at special unit price. (Signed)

11. B. Wheelock,	W. S. Shields,
Thomas H. Mullan,	B. E. Grant,
Joseph C. Lewellyn,	A. Lanquar,
L. G. Hallberg,	Addison E. Wells,
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SPECIFICATIONS FOR PLAIN CONCRETE FLOORS

WM. M. KINNEY, M. E.

That preference for concrete as a building material is on the increase is evident even to the casual observer as well as to the architect and engineer. Yet from time to time we hear expressions of dissatisfaction with certain classes of concrete construction, that are voiced in such a manner as to convey the impression to the uninitiated that the material is not always all it is claimed to be. Any material used according to recognized best practice in construction for which it is adapted, will give the maximum efficiency capable with that material. On the other hand, no material used contrary to best practice can be expected to give satisfactory results. Take, for instance, the subject of concrete floors. That this question is of more than passing interest is evidenced in the following editorial, which appeared in *Engineering Record* for November 14, 1914:

"Why is it that in two concrete buildings apparently constructed under identical conditions, built by contractors of equal intelligence and integrity, from concrete composed of similar aggregates and the same brand of Portland cement, the floors in one will turn out hard, firm and resistant to abrasion, while in the other ordinary usage will result in dusting sufficient to make necessary some remedial measures?"

"The fact that numerous dustless concrete floors have been laid seems to indicate that the trouble must lie in the selection, proportioning, mixing, placing or finishing of the material. The procedure and proportions described below have given excellent results, though undoubtedly different mixes have also been used with satisfaction.

"Special precautions should be taken to insure first-class work. A rich mixture is desirable, say, a 1:1:1 mix, in which the aggregate consists of granite, or other hard stone, screenings graded from $\frac{1}{4}$ in. in size down to the finest, and crushed stone of equal quality passing a $\frac{1}{2}$ -in. ring and retained on a screen having a $\frac{1}{4}$ -in. mesh. All troweling and finishing of the floor surface should be completed within $2\frac{1}{2}$ hours from the time the materials leave the mixer. This necessitates mixing the material for the wearing course to such consistency that the mortar has to be scraped from the wheelbarrows and will hardly flatten out when dumped upon the floor, yet wet enough so that it can be 'struck off' with little difficulty when spread out with shovels. The floor usually is in a condition to be troweled for the last time within an hour and a half or two hours after the wearing course has been mixed. When sufficiently hardened to prevent pitting the floor should be sprinkled with water until 2 inches of sawdust can be thrown on the surface without injury. The sawdust should be thoroughly wet down and kept moist by sprinkling for a period of two weeks.

"Numerous experiments in curing concrete have demonstrated conclusively the superior quality of specimens which are properly cured by being kept moist for a period of two weeks or more. Wetting is quite common with other types of concrete work and can be relied upon to give as satisfactory results with floors.

"There are so-called hardeners on the market intended to be used with the finishing coat. In using these preparations careful supervision of the work from the time the concrete is mixed to the time that traffic is allowed on the floor is made a prime requisite for success. In all probability if the same care and attention are given to the workmanship and curing of floors in which no integral preparation is used, an excellent surface will result."

This editorial suggests that one of the most frequent causes of complaint is the dusting of concrete floors; and further, the above editorial expressions should make plain that even if only one example of a dustless concrete floor could be pointed out, duplication of this effort must be possible—that the dusting where it does occur must be the result of neglect to observe one or more of the fundamental requirements of construction.

Extensive investigation has disclosed the fact that although several factors may be the determining ones in the dusting of concrete floors, none of these is other than a departure from good practice in any kind of concrete construction. Dusting may result from too fine, dirty, or otherwise unsuitable sand; too little cement in the mixture; too much time allowed to elapse between mixing and finishing; troweling at several intervals after hardening has commenced and thus disturbing the process of crystallization of the cement in hardening; the use of dryers; and, finally, permitting the mortar to dry out too rapidly after placing.

The following specifications apply to plain concrete floors that are to be subjected to considerable wear and cover the preparation of the sub-base and the laying, finishing and curing of the floor. These are based on recommendations made after careful study of the subject by the American Concrete Institute. If the method of construction outlined in these specifications is followed, a concrete floor free from dusting, hence one that will give the maximum efficiency capable with the material—will result.

SUGGESTED SPECIFICATIONS FOR PLAIN CONCRETE FLOORS.

I. Materials.

1. Cement: The cement shall meet the requirements of the Standard Specifications for Portland Cement of the American Society for Testing Materials, adopted August 16, 1909, as revised to date by said society.

2. Aggregates: Before delivery on the job, the contractor shall submit to the architect or engineer a fifty (50) pound sample of each kind of aggregate proposed for use. These samples shall be tested and if found to pass the requirements of the specifications, similar material shall be considered as acceptable for the work. All aggregates used shall meet with the approval of the architect or engineer and shall fulfill the requirements of these specifications. In no case shall aggregates containing frost or lumps of frozen materials be used.

Fine Aggregate: Fine aggregate shall consist of natural sand, or screenings from hard, tough, durable crushed rock or gravel, consisting of quartzite grains or other equally hard material, graded from fine to coarse, with the coarse particles predominating. Fine aggregate, when dry, shall pass a screen having four (4) meshes per linear inch; not more than twenty-five (25) per cent shall pass a sieve having fifty (50) meshes per linear inch, and not more than five (5) per cent shall pass a sieve having one hundred (100) meshes per linear inch. Fine aggregate shall not contain vegetable or other deleterious matter nor more than three (3) per cent of clay or loam.

Fine aggregate shall be of such quality that mortar composed of one (1) part Portland cement and three (3) parts fine aggregate, by weight, when made into briquets, shall show a tensile strength at seven (7) days and twenty-eight (28) days at least equal to the strength of briquets composed of one (1) part of the same cement and three (3) parts standard Ottawa sand, by

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weight. The percentage of water used in making the briquets of cement and fine aggregate shall be such as to produce a mortar of the same consistency as that of the Ottawa sand briquets of standard consistency. In other respects all briquets shall be made in accordance with the Report of Committee on Uniform Tests of Cement of the American Society of Civil Engineers.

Coarse Aggregate: Coarse aggregate shall consist of clean, durable crushed rock or gravel, graded in size, free from vegetable or other deleterious matter, and shall contain no soft, flat or elongated particles. The size of the coarse aggregates shall be such as to pass a one and one-half ($1\frac{1}{2}$) inch round opening and shall range from one and one-half ($1\frac{1}{2}$) inches down, not more than five (5) per cent passing a screen having four (4) meshes per linear inch.

Aggregate for Wearing Course: Aggregate for the wearing course shall consist of clean, hard, tough, durable crushed rock or gravel, free from vegetable matter, and shall contain no soft, flat or elongated particles. It shall pass, when dry, a screen having one-half ($\frac{1}{2}$) inch openings and not more than ten (10) per cent shall pass a screen having four (4) meshes per linear inch.

3. Mixed Aggregate: Crusher-run stone, bank-run gravel or artificially prepared mixtures of fine and coarse aggregate shall not be used.

4. Subbase: Only clean, suitable material, such as steam-boiler cinders or gravel, not exceeding four (4) inches in the largest dimension shall be used in the subbase.*

5. Water: Water shall be clean, free from oil, acid, alkali or vegetable matter.

6. Color: If artificial coloring material is required, only mineral colors shall be used.

7. Reinforcement: The reinforcing metal shall meet the requirements of the Standard Specifications for Steel Reinforcement, adopted March 16, 1910, by the American Railway Engineering Association.

8. Joint Filler: The joint filler shall be a suitable elastic waterproof compound that will not become soft and run out in hot weather, nor hard and brittle and chip out in cold weather, or prepared strips of fiber matrix and bitumen as approved by the architect or engineer.

II. Subgrade.

9. Depth: (a) The subgrade shall not be less than eleven (11) inches below the finished surface of the floor.

(b) The subgrade shall not be less than five (5) inches below the finished surface of the floor.

10. Preparation: All soft and spongy places shall be removed and all depressions filled with suitable material which shall be thoroughly compacted in layers not exceeding six (6) inches in thickness. The subgrade shall be thoroughly tamped until it is brought to a firm, unyielding surface.

11. Deep Fills: When a fill exceeding one (1) foot in thickness is required to bring the work to grade, it shall be made in a manner satisfactory to the architect or engineer. The use of muck, quicksand, soft clay, spongy or perishable material is prohibited.

12. Drainage: When required, a suitable drainage system shall be installed and connected with sewers or other drains indicated by the engineer.

*NOTE: When a subbase is required, eliminate paragraph 9 (b). When a subbase is not required, eliminate paragraphs 4 and 9 (a), 13 and 14. Unless paragraph 9 (a) is eliminated 9 (b) is void.

III. Subbase.

13. Thickness: On the subgrade shall be spread a material as hereinbefore specified, which shall be thoroughly rolled or tamped to the surface at least five (5) inches below the finished grade of the floor. On fills, the subbase shall extend the full width of the fill and the sides shall have the same slope as the sides of the fill.

14. Wetting: While compacting the subbase the material shall be kept thoroughly wet and shall be in that condition when the concrete is deposited.

IV. Forms.

15. Materials: Forms shall be free from warp and of sufficient strength to resist springing out of shape.

16. Setting: The forms shall be well staked or otherwise held to the established lines and grades and their upper edges shall conform to the established grade of the floor.

17. Treatment: All wood forms shall be thoroughly wetted and metal forms oiled before depositing any material against them. All mortar and dirt shall be removed from forms that have been previously used.

V. Construction.

18. Size of Slabs: The slabs or independently divided blocks, when not reinforced, shall have an area of not more than one hundred (100) square feet, and shall not have any dimension greater than ten (10) feet. Larger slabs shall be reinforced as hereinafter specified.

19. Thickness of Floor: The thickness of the floor shall be not less than five (5) inches.

20. Width and Location of Joints: When required by the architect or engineer in charge, a one-half ($\frac{1}{2}$) inch space or joint shall be left between the floor and the walls and columns of the building.

21. Protection of Edges: Where required by the engineer in charge, the joints shall be protected by metal. Unless protected by metal, the upper edges of the concrete shall be rounded to a radius of one-half ($\frac{1}{2}$) inch.

V. Measuring and Mixing.

22. Measuring: The method of measuring the materials for the concrete or mortar, including water, shall be one which will insure separate uniform proportions at all times. A bag of Portland cement (94 pounds net) shall be considered one (1) cubic foot.

23. Machine Mixing: When mixing by machine, a batch mixer of an approved type shall be used. The ingredients of the concrete or mortar shall be mixed to the specified consistency, and the mixing shall continue until the cement is uniformly distributed and the mass is uniform in color. Raw materials shall not be permitted to enter the drum until all the material of the preceding batch has been discharged.

24. Hand Mixing: When it is necessary to mix by hand, the materials shall be mixed dry on a water-tight platform until the mixture is of uniform color, the required amount of water added, and the mixing continued until the mass is homogeneous and of uniform consistency.

25. Retempering: Retempering, that is, remixing with additional water or materials, mortar or concrete that has partly hardened, will not be permitted.

VII. Concrete Base.

26. Proportions: The concrete shall be mixed in the proportions, by volume, of one (1) sack Portland cement, two and one-half ($2\frac{1}{2}$) cubic feet fine aggregate and five (5) cubic feet coarse aggregate.

27. Consistency: The materials shall be mixed wet enough to produce a concrete of

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a consistency that will flush readily under slight tamping, but which can be handled without causing a separation of the coarse aggregate from the mortar.

28. Placing: After mixing, the concrete shall be handled rapidly and the successive batches deposited in a continuous operation completing individual sections to the required depth and width. Under no circumstances shall concrete that has partly hardened be used. The forms shall be filled and the concrete struck off and tamped to a surface the thickness of the wearing course below the established grade of the floor. The method of placing the various sections shall be such as to produce a straight, clean-cut joint between them so as to make each section an independent unit.

29. Reinforcement: Slabs having an area of more than one hundred (100) square feet, or having any dimension greater than ten (10) feet, shall be reinforced with wire fabric, or with plain or deformed bars. The cross-sectional area of metal shall amount to at least 0.041 square inches per linear foot transversely and parallel to center line of floor. The reinforcement shall be placed upon and slightly pressed into the concrete base immediately after the base is placed and shall not cross joints and shall be lapped sufficiently to develop the full strength of the metal.

VIII. Wearing Course.

30. Proportions: The mortar shall be mixed in the proportions of one (1) sack of Portland cement, one (1) cubic foot of fine aggregate and one (1) cubic foot of aggregate for wearing course.

31. Consistency: The mortar shall be of the driest consistency possible to work with a sawing motion of the strikeboard.

32. Thickness: The wearing course of the floor shall have a minimum thickness of three-quarter ($\frac{3}{4}$) inch.

33. Placing: The wearing course shall be placed immediately after mixing. It shall be deposited on the fresh concrete of the base before the latter has appreciably hardened, and brought to the established grade with a strikeboard.

34. Finishing: After the wearing course has been brought to the established grade by means of a strikeboard, it shall be worked with a wood float in a manner which will thoroughly compact it and provide an even surface. When required, the surface shall be steel troweled, but excessive working shall be avoided.

35. Coloring: If artificial coloring is used, it must be incorporated with the entire wearing course, and shall be mixed dry with the cement and aggregate until the mixture is of a uniform color. In no case shall the amount of coloring exceed five (5) per cent of the weight of the cement.

IX. Protection.

36. Treatment: As soon as the finished floor has hardened sufficiently to prevent damage thereby, the floor shall be covered with at least one (1) inch of wet sand, or two (2) inches of wet sawdust, which shall be kept wet by sprinkling with water for at least ten (10) days. The freshly finished floor shall be protected from hot sun and drying winds until it can be sprinkled and covered as above specified.

37. Temperature Below 35 Degrees Fahrenheit: If at any time during the progress of the work the temperature is, or in the opinion of the architect or engineer will within twenty-four (24) hours drop to 35 degrees Fahrenheit, the water and aggregates shall be heated and precautions taken to protect the work from freezing for at least five (5) days. In no case shall concrete be deposited upon a frozen base.

These specifications plainly direct or imply the following fundamentals:

Clean, hard, well graded aggregates.
Clean water.
Proper consistency of concrete.
Proper curing.

The wearing course should be placed immediately after depositing the base so that a perfect bond will obtain between the two courses and the consistency of the wearing course should be such, when deposited, as will permit finishing to final surface in one operation within, say, 20 minutes after placing.

Too much water in the top course invariably compels several trowelings to secure the surface finish desired and frequent troweling after hardening of the cement has commenced breaks up the attendant processes of crystallization, thus affecting the ultimate wearing quality of the surface. Besides, over-troweling brings a film of cement and fine material to the surface which sets too quickly to attain proper strength, thus resulting in a surface devoid of wearing quality.

Proper curing of the floor. This perhaps does more to eliminate subsequent dusting than does minute observation of some of the other requirements, although none should be slighted.

Moisture is a necessary element for the hardening of concrete. Just as soon as possible after having finished the top course to the desired surface, the floor should be covered with a layer of protective material consisting of two inches or more of wet sand or sawdust, this covering to be kept wet by frequent sprinkling for from ten days to two weeks to prevent rapid drying out of the concrete.

Remedial treatments of several kinds may be used with from fair to indifferent success in temporarily allaying dusting of old concrete floors, but from the very nature of these treatments, which are essentially surface applications, renewal is required from time to time. Turpentine and boiled linseed oil combined in such proportions as to be readily absorbed by the floor surface form a mixture that will temporarily allay dusting. It is suited, however, only to old or thoroughly cured concrete and will somewhat darken the color of the floor.

If the wearing course of an old floor has separated from the base, or from whatever cause disintegrated so that resurfacing is necessary, a new wearing course that will be dustless may be applied by following the essentials of the foregoing specifications, if the old base is in good condition. First, however, all loose particles, preferably all of the old top course, must be removed, so as to expose the base, which must then be thoroughly cleansed by brushing and washing, followed by an application of a solution of 1 part hydrochloric acid to 3 or 4 parts of water, this being applied by a brush containing no metal. After having been allowed to remain from 10 to 15 minutes the acid wash must be thoroughly removed with clean water applied by a hose. An acid treatment such as described will expose the surface of aggregates in the base so that new concrete will more readily bond. Before placing the new top course, a grout of neat cement and water mixed to the consistency of thick cream should be applied to the cleansed surface of the base. Only a small area should be treated with grout at one time so that concrete for the new wearing course may be applied before the grout paint has commenced to harden. If the requirements of consistency, finishing or troweling, and protection to insure proper curing, are observed, the refinished floor will be dustless.

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THE DESIGN OF WIND BRACING IN STEEL SKELETON CONSTRUCTION

W. M. Wilson, M. M. E., C. E., Assistant Professor of Structural Engineering,
University of Illinois

DEFINITION OF STEEL SKELETON CONSTRUCTION. By steel skeleton construction is meant that type of building construction in which the frame is made up of a system of steel columns and girders so planned that the loads from the walls and floors are delivered by the girders to columns at each story. Each floor slab is supported on steel beams, and at each floor the walls are supported on steel beams framed into the columns, so that the floors and walls of one story, so far as support is concerned, are entirely independent of the floors and walls of all other stories. As seen in elevation, the steel work of such a building is made up of a series of rectangular frames. This is the type of construction that is used in practically all modern high buildings.

2. HOW A STEEL SKELETON FRAME RESISTS WIND PRESSURE. The wind pressure on a building acts upon the outside wall and is delivered by the wall to the steel frame. It is customary to assume that the wind load is applied to the steel frame at the level of the floors only. A bent of a building which is designed to resist the wind load is, therefore, considered as being acted upon by a series of concentrated horizontal forces acting at the various floors. The force at the top of the top story tends to make the top of the story move horizontally relative to the bottom of the story. For a 20 story bent, the force at the top of the 20th story and also the one at the top of the 19th story tend to make the top of the 19th story move horizontally relative to the bottom of that story. In the same way, for any story, all of the forces above tend to make the top move horizontally relative to the bottom of the story. The bottom of a story is prevented from moving horizontally by its connection to the foundation through the intervening stories of the bent. For any story, therefore, the forces acting on the bent above the story in question tend to move the top of the story in one direction whereas the stories below act horizontally upon the bottom of the story, in the opposite direction, to prevent it from moving in response to the forces above. That is, there is a shear in the story, and this shear is equal to the sum of the horizontal forces acting upon the bent above the story in question, including the force at the top of the story.

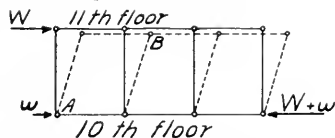


Fig. 1—Frame with Hinged Joints. Vertical forces not shown.

Fig. 1 represents the 10th story of a three-span bent. The force W applied at the 11th floor is equal to the sum of all the horizontal forces above, including the one at the 11th floor. It tends to push the top of the 10th story to the right. The force w is the wind load at the 10th floor. The force $W+w$ is the resistance which the 9th story offers to prevent the bottom of the 10th story from moving to the right. If the columns and girders were hinged at the corners the frame would collapse as indicated by the dotted lines. The bracing added to prevent the frame from collapsing is called the wind bracing.

The easiest way to prevent the frame from collapsing would be to put in a diagonal tension member from A to B . This, however,

it is not practicable to do inasmuch as the diagonal bracing in the exterior walls would interfere with the windows, and all interior walls must be made so that they can be removed to meet the changing needs of the tenants. It is therefore necessary to make the frame capable of resisting shear without interfering with the clear rectangular space between the columns and girders.

If the connections between the columns and girders are made rigid, that is if the columns cannot turn relative to the girders, the frame, when subjected to a shear, instead of collapsing will take the form shown in Fig. 2. The columns of this latter frame tend to fall over to the right, the same as the columns of the frame in Fig. 1, but the girders at the tops of the columns hold the top ends in a nearly vertical position and likewise the girders at the bottom hold the bottom ends in a vertical position. That is, a column as a whole is not free to fall over, and the top can only move to the right by moving relative to the bottom when both the top and bottom remain in a nearly vertical position. Under these conditions a column is capable of resisting a horizontal shear.

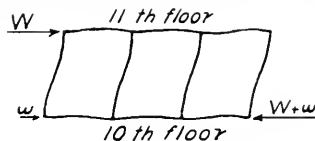


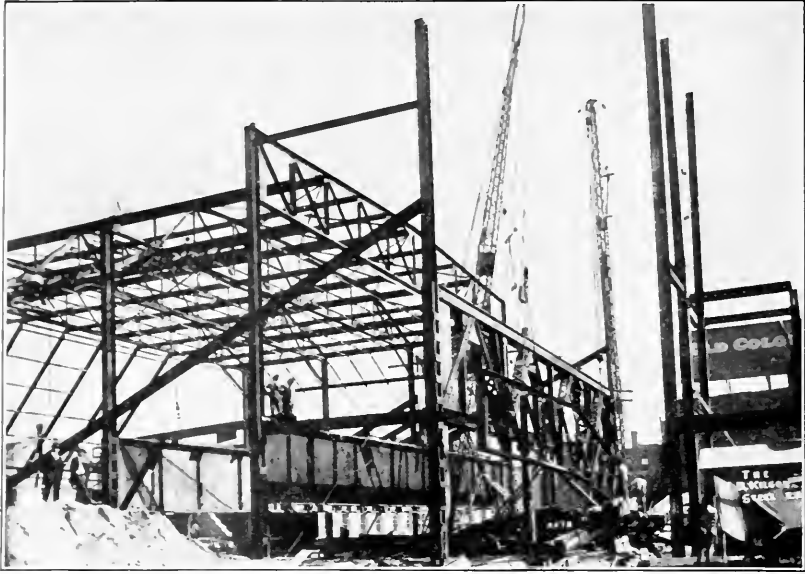
Fig. 2—Frame with Fixed Joints. Vertical forces not shown.

The columns naturally take the position shown by the dotted lines in Fig. 1, that is, they tend to rotate, and they are prevented from rotating only because the girders hold the ends in a nearly vertical position. In other words, and this is a fact that should be kept clearly in mind, the columns are the overturning members and the girders are the resisting members.

As stated above, the columns represented in Fig. 2 are subjected to shear. Since it is considered that no horizontal forces act upon the steel frame between the floors, the shear on a column is uniform for a story height. This shear produces a bending moment in the column, that is, the stress in the column due to the wind is tension on one side and compression on the other. From the form which the column takes when strained, it is apparent that for a particular side of any column if the stress at one end is compression that at the other end is tension, or the reverse. That is, the bending moment and also the bending stress changes sign, or passes through zero, some place between the two ends of the column. The point where the moment changes sign is called the point of contra-flexure. The conditions at this point are the same, as far as stresses are concerned, as if the column were cut and the two parts were connected with a frictionless hinge. There is a shear but there is no moment at the point of contra-flexure.

Since a girder is subjected to forces resulting from the wind load only at points where the girder is connected to the columns, the shear on a girder is uniform between columns. The shear in the girder produces a bending moment and this bending moment changes sign in the girder the same as in a column.

3. METHODS OF CALCULATING WIND STRESSES. In Fig. 2 the action of the portion of the bent above the 10th story, upon the 10th story is represented as a sin-



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gle force W ; and the action of the 10th story upon the story below is likewise represented as a single force $W+w$. In reality the horizontal shear is transmitted from story to story through the columns.

If a column is divided at the point of contra-flexure, represented in Fig. 3 by a

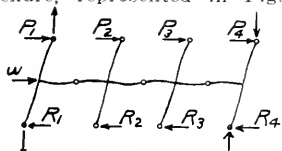


Fig. 3—Tenth Floor Girders.

small circle, the upper portion of the column will exert upon the lower portion a horizontal shear, but no moment. (There is also a vertical force, but it is neglected in this discussion.) The total shear above the 10th floor is represented by W . It is equal to the sum of the shears, P_1 , P_2 , P_3 and P_4 , in the columns. The shear is constant between the 10th and 11th floors, whereas the moment varies and passes through zero at the point of contra-flexure.

If the columns in the story just below the 10th floor are divided at the point of contra-flexure the lower portion of each column will exert upon the upper portion a shear, but no moment. These shears are represented by R_1 , R_2 , R_3 and R_4 . Likewise if each girder is divided at its point of contra-flexure each part will exert upon the other part a shear, but no moment.

If the dimensions of a building are known and a wind pressure, for the purpose of design, is assumed, the total shear upon each story of the building can be determined. If therefore the distribution among the columns of the total shear upon a story is known, and the location of the point of contra-flexure of all members is known, the bending moment in the columns and girders can be determined. Unfortunately, however, an exact mathematical determination of the above quantities is very long and complicated.

While some effort has been made to devise an exact analysis of the wind stresses in the steel frames of office buildings,* designers of buildings for the most part, have been content to use approximate methods.

Four approximate methods have been used. For convenience in reference these will be designated as Method I, Method II, Method III, and Method IV, respectively. Mr. R. Fleming presented the first three methods in Engineering News.* These methods, as applied to a building in which all columns of a story have the same section, are based upon the following assumptions:

ASSUMPTIONS IN METHOD I.

1. A bent of a frame acts as a cantilever.
2. The point of contra-flexure of each column is at mid-height of the story.
3. The point of contra-flexure of each girder is at its mid-length.

4. The direct stress in a column is directly proportional to the distance from the column to the neutral axis of the bent.

ASSUMPTIONS IN METHOD II.

1. A bent of a frame acts as a series of portals.

*Note.—Wind Stresses in the Frames of Office Buildings, by Albert Smith, Journal Western Society of Engineers, Vol. XX, No. 4, p. 341.

Stresses in Tall Buildings, by Cyrus A. Melick, Bulletin No. 8, College of Engineering, University of Ohio.

The Theory of Frameworks with Rectangular Panels and Its Application to Buildings, which have to Resist Wind, by Ernst F. Jonson, Trans. Am. Soc. C. E., Vol. 55, p. 413.

*Wind Bracing without Diagonals for Steel-frame Office Buildings, Engineering News, March 13, 1913.

2. The point of contra-flexure of each column is at mid-height of the story.

3. The shear is the same on all columns of a story.

4. Each pair of adjacent columns of a bent acts as a portal, and each interior column is a member of two adjacent portals. The direct stress in an interior column, when the column is considered as a member of the portal on one side, is of opposite sign from the direct stress in the same column when considered as a member of the portal on the opposite side, and the resultant direct stress is equal to zero.

ASSUMPTIONS IN METHOD III.

1. A bent of a frame acts as a continuous portal.

2. The point of contra-flexure of each column is at mid-height of the story.

3. The direct stress in a column is directly proportional to the distance from the column to the neutral axis of the bent.

4. The shear is the same on all columns of a story.

Professor Albert Smith, in a paper before the Western Society of Engineers, describes a method which he has used in his classes in Structural Engineering at Purdue University. This method is here designated as Method IV:

ASSUMPTIONS IN METHOD IV.

1. The point of contra-flexure of each column is at mid-height of the story.

2. The point of contra-flexure of each girder is at its mid-length.

3. The shears on the interior columns are equal and the shear on each exterior column is equal to one-half of the shear on an interior column.

If all of the assumptions of any one of these methods are accepted, the stresses in a frame may be determined by applying the fundamental equations of static equilibrium.

The four approximate methods described above are all short and simple and, when any one of them is considered by itself, the assumptions upon which it is based seem reasonable. It is an unfortunate fact, however, that if the four methods are applied to the same frame, the results obtained by the four methods are radically different. Furthermore, in the absence of an accurate method to be used as a standard of comparison, it was impossible to judge of the relative accuracy of the approximate methods.

As a result of an investigation made jointly by the writer and G. A. Maney, described in Bulletin No. 80 of the Engineering Experiment Station of the University of Illinois, it was found that for bents symmetrical about the centerline and having columns of equal section, Method I and Method IV described above are accurate enough to be used in the design of a building, but that Method II and Method III are so inaccurate that they should never be used.

Since Method IV is as accurate as Method I, and since it is very much simpler, it is the method which the writer recommends.

4. APPLICATION OF METHOD.—Wind bracing may be in every bent of a building frame, but it is customary to have the bracing only in the exterior walls and in interior bents where the connections interfere the least with the clear space in the rooms. Unless the floor has a large number of openings, stair and elevator wells, etc., the floor slab will act as a horizontal girder to transmit the wind load horizontally to the bents containing wind bracing. If the floor contains a number of openings it may be necessary to imbed diagonal steel bracing in the floor slab to transmit the wind load to the bents containing wind bracing.

The first step in determining the wind stresses in a bent is to determine the shear upon each story of the bent. This shear is a function of the wind pressure, of the width of wall supported against wind by the bent in question, and of the distance from



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the middle of the story in question to the top of building. If the building is 80 feet long and has wind bracing in the end bents only; if the distance from the middle of the fifth story to the top of the exterior wall, the highest point on the building, is 120 feet; and if the specifications require that the building be designed to withstand a wind pressure of 20 lbs. per sq. ft., the requirement in the Revised Building Ordinances of the City of Chicago, then the total shear on the fifth story is

$$\frac{80}{2} \times 120 \times 20 = 96,000 \text{ lb.}$$

According to assumption 3 of Method IV the shear on each interior column is equal to the total shear on the bent divided by one less than the number of columns in the bent, or it is equal to the total shear on the bent divided by the number of spans in the bent. The shear on each exterior column is one-half of the shear on each interior column. If the bent in question has four columns or three spans, then the shear on each interior column is

$$\frac{96,000}{3} = 32,000 \text{ lb. and the shear}$$

$$\text{on each exterior column is } \frac{32,000}{2} = 16,000 \text{ lb.}$$

According to assumption 1, the point of contra-flexure is at the mid-height of the story. If the fifth story is 12 feet high, measured from finished floor line to finished floor line, the moment in each interior column is

$$32,000 \times \frac{12}{2} \times 12 = 2,304,000 \text{ in. lb.,}$$

$$\text{and the moment on each exterior column is } 16,000 \times \frac{12}{2} \times 12 = 1,152,000 \text{ in. lb.}$$

The increment of the wind load acting on the bent at the 5th floor is half of the wind load on the wall between the 5th floor and the 6th floor plus half of the wind load on the wall between the 5th floor and the 4th floor. If the 4th story is 13 feet high then the wind load applied at the 5th floor

$$\text{is } \left(\frac{12}{2} + \frac{13}{2} \right) \times \frac{80}{2} \times 20 = 10,000 \text{ lb., and the total}$$

$$\text{shear on the 4th story of the bent is } 96,000 + 10,000 = 106,000 \text{ lb. The shear in each}$$

$$\text{interior column is } \frac{106,000}{3} = 35,333 \text{ lb. and in}$$

$$\text{each exterior column is } \frac{35,333}{2} = 17,666 \text{ lb.}$$

$$\text{The moment at the top of the interior columns of the 4th story is } 35,333 \times \frac{13}{2} \times 12 =$$

$$2,765,000 \text{ in. lb., and the moment at the top of the exterior columns is } 17,666 \times \frac{13}{2} \times 12 =$$

$$1,378,000 \text{ in. lb.}$$

The single girder connected to the exterior column at the 5th floor must resist the moment at the lower end of the exterior column in the 5th story and the moment at the upper end of the exterior column in the 4th story. The moment at the point where the girder connects to the exterior column is therefore $1,152,000 + 1,378,000 = 2,530,000$ in. lb.

According to assumption 2 the point of contra-flexure of a girder is at the center, and as the shear in the girder is constant, the moments at the two ends are equal. The moment to be resisted at the point where the girders are connected to an interior column is just twice as great as at the corresponding point on an exterior column. Since the moment to be resisted at the interior column is twice as great as the moment to be resisted at the exterior column; since the moment at the interior column is resisted by two girders; and since the moment in one of these girders is the

same as the moment at the exterior column and therefore one-half of the total moment to be resisted by the girders at the interior column, it follows that the moments in the two girders connected to the interior column are equal to each other and equal to the moment in the girder where it connects to the exterior column. This, in fact, is one of the convenient features of Method IV, the moments at the ends of all girders of a floor are equal.

In the design of a building a large number of calculations are required which are very similar, and it is usually advantageous to make these calculations in the form of the accompanying table. In this table column 1 gives the vertical dimensions of the building. Column 2 gives the increments in the shear at the different floors. The first increment is the total wind load on the portion of the building above the middle of the 7th story. It is equal to $96 \times 40 \times 20 = 76,800$ lb. The increment at each succeeding floor is the sum of half of the wind load on the wall of the story above and half of the wind load on the wall of the story below the floor in question, for example, the increment at the 4th floor is $13.5 \times 40 \times 20 = 10,800$

$$\text{lb., in which } 13.5 \text{ is } \frac{14}{2} + \frac{13}{2}. \text{ Column 3 gives}$$

the total shear on each story. It is equal to the sum of all the increments above the story in which the shear is to be determined. Column 5 gives the shear on the interior columns. It is equal to the total shear on the story, given in Column 3, divided by the number of spans in the bent, in this case 3. Column 4 gives the shear in the exterior columns. It is one-half the shear in the interior columns given in Column 5. Column 6 gives the moment in the exterior columns. It is equal to the shear in the column multiplied by one-half of the story height. Column 7 gives the moment in the interior columns. Column 8 gives the moment in the girders. It is equal to the moment in the exterior column in the story just above the girder plus the moment in the exterior column in the story just below the girder. This moment for any girder is the sum of the moments given in Column 6 for the stories just above and just below the girder, for example, the moment in the girder at the top of the 4th story is $1,152,000 + 1,378,000 = 2,530,000$ in. lb.

As the shear is constant in all members the moment varies as the ordinates of a straight line from zero at the point of contra-flexure, assumed to be at the middle of the member, to a maximum at the ends.

5. **Design of Members.**—In determining the size of members wind load stresses must be combined with dead load and live load stresses. The girders and columns and the joints connecting the girders and columns may all be affected by the wind stresses.

According to most specifications when wind load stresses are combined with dead load and live load stresses, the allowable unit stresses are increased 50%, providing, however, that the members must be able to carry the dead load and live load alone at the usual working stresses.

The size of the columns is not always affected by the wind loads. It is customary to design them for dead load and live load only and then check for wind load. To illustrate, consider an interior column of the 5th story. Consider the dead load and live load combined to be 1,000,000 pounds. The section of a column made up of a web plate $14 \times \frac{5}{8}$, 4 angles $6 \times 1 \times \frac{5}{8}$, and 2 cover plates $11 \times 1 \frac{1}{2}$ has the following properties: area

$$77.69 \text{ sq. in., moment of inertia } 1018 \text{ in.}^4, \text{ radius of gyration } 3.51 \text{ in., and distance from neutral axis to outer fiber } 8.875 \text{ in. The unit stress due to dead load and live load is } \frac{1,000,000}{77.69} = 12,880 \text{ lb. per sq. in., and}$$

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the allowable unit stress is $16,000 - 70 \frac{144}{3.51} = 13,130$ lb. per sq. in. The section selected will carry the dead and live load. It remains to check for combined dead, live and wind loads. The bending stress due to $\frac{2,304,000 \times 8.875}{2} = 5050$ lb. the wind load is

per sq. in. and the total unit stress is $12880 + 5050 = 17,930$ lb. per sq. in. The allowable unit stress for combined dead load, live load, and wind load is $1.5 \times 13,130 = 19,695$ lb. per sq. in. The column section is therefore not affected by the wind load. There is also an axial stress in the column due to the wind load but it is usually neglected.

The girders which form a part of the wind bracing usually carry either a portion of the wall or floor and may carry both, nevertheless the wind load materially affects the size of girder required. As the girder is connected to the column with a rigid joint in order that it may resist the bending moment due to wind, the girder in carrying the wall or floor does not act as a simple beam, but acts as a beam with restrained ends. The end of the girder connected to the exterior column is restrained by the columns, but it is not held perfectly rigid due to the fact that the exterior column has a girder connected on one side only. The interior columns, having girders on both sides, hold the ends of the girders more nearly rigid, so that it is well to consider the girders as being held perfectly rigid at the ends. For a uniformly distributed load W the moments at the ends of a girder will therefore

be taken at $\frac{1}{2} - Wl$.

Consider that the girders of the bent are 20 feet long and carry a uniformly distributed dead load of 2,000 lb. per ft. The moment due to this load at the ends of the girder is $1 \frac{1}{2} \times (2,000 \times 20) \times (20 \times \frac{1}{2}) = 800,000$ in. lb. Since the dead load moment and the wind load moment are both a maximum at the end, and since the wind load moment can be of either sign, depending upon which way the wind is blowing, the maximum combined moment is at the end of the girder, and it is equal to the numerical sum of the

dead load and wind load moments. In this case it is $800,000 + 2,530,000 = 3,330,000$ in. lb.

The maximum dead load shear occurs at the end, and is equal to $\frac{2,000 \times 20}{2} = 20,000$ lb.

Since there are no wind loads applied to the girder except at the columns, the shear due to the wind load is constant. Since, by assumption 2, the point of contra-flexure, the point of zero moment, is at the middle of the girder the moment at the end of the girder is equal to the shear times the half length of the girder, and conversely, the shear in the girder is equal to the moment divided by one-half the length of the span. In this case the wind load shear is therefore

$\frac{3,330,000}{10} = 333,000$ lb. and the maximum combined shear is $21,080 + 20,000 = 41,080$ lb.

The design of the girder for the wind bracing is therefore reduced to the problem of designing a girder to withstand a bending moment of 3,330,000 in. lb. and a shear of 41,080 lb. As these stresses are due to the combined dead load and wind load, the allowable unit stress to be used is 50% greater than is permitted for dead and live load only. A girder made up of a 24"x4" web plate and 4-5"x3 $\frac{1}{2}$ "x $\frac{1}{2}$ " flange angles will meet the requirements.

As the maximum moment and the maximum shear on the girder both occur at the point where the girder is connected to the column, the moment and shear which have been used to determine the size of the girder will also determine the joint connecting the girder to the column. The design of the joint is therefore reduced to the problem of designing a connection that will withstand a bending moment of 3,330,000 in. lb. and a shear of 41,080 lb. As in the case of the girder, the allowable unit stresses are 50% greater than is permitted for dead and live load only. As the bending moment is large compared to the shear, the joint should be planned primarily to withstand moment.

*Note.—For detailed description of method of designing joints to withstand moments see Steel Construction by Burt, page 255.

CALCULATIONS FOR WIND STRESSES

Wind Load on Vertical Strip 40 Ft. Wide	Shear Pounds		Moment Inch Pounds			
Increase	Total Above	Exterior Column	Interior Column	Exterior Column	Interior Column	Girder
	76800	12800	25600			
7th Fl.	9600			921000	1842000	1959000
6 " "	9600	14400	28800	1038000	2076000	2190000
5 " "	10000	16000	32000	1152000	2304000	2530000
4 " "	10800	17666	35333	1378000	2756000	3011000
3rd "	11200	19466	38933	1633000	3266000	3425000
2nd "	13600	21333	42666	1792000	3584000	4624000
1st "	141600	23600	47200	2832000	5664000	

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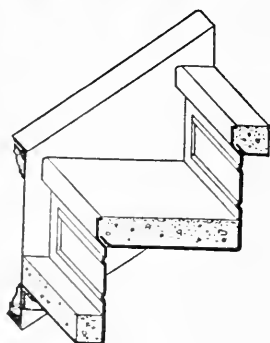
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I. Manufacture.

1. (a) Structural steel, except as noted in Paragraph (b), may be made by the Bessemer or the open-hearth process.

(b) Rivet steel, and steel for plates or angles over $\frac{3}{4}$ inch in thickness which are

to be punched, shall be made by the open-hearth process.

II. Chemical Properties and Tests.

2. The steel shall conform to the following requirements as to chemical composition:

	Structural Steel.	Rivet Steel.
Phosphorus.....	not over 0.10 per cent	.....
Sulfur.....	" " 0.06 " "	not over 0.06 per cent
Bessemer.....	.....	" " 0.045 " "
Open-hearth.....	.....	.....

3. An analysis to determine the percentages of carbon, manganese, phosphorus and sulfur shall be made by the manufacturer from a test ingot taken during the pouring of each melt, a copy of which shall be given to the purchaser or his representative. This analysis shall conform to the requirements specified in Section 2.

4. Analysis may be made by the purchaser from finished material representing each melt, in which case an excess of 25 per cent above the requirements specified in Section 2 shall be allowed.

III. Physical Properties and Tests.

5. (a) The material shall conform to the following requirements as to tensile properties:

Properties Considered.	Structural Steel.	Rivet Steel.
Tensile strength, lb. per square inch.....	55 000—65 000	45 000—55 000
Yield point, minimum, per square inch....	0.5 tens. str.	0.5 tens. str.
Elongation in 8 in., minimum, per cent.....	1 400 000a	1 400 000
Elongation in 2 in., minimum per cent.....	Tens. str. 22	Tens. str.

a See Section 6.

(b) The yield point shall be determined by the drop of the beam of the testing machine.

6. (a) For structural steel over $\frac{3}{4}$ inch in thickness, a deduction of 1 from the percentage of elongation in 8 in. specified in Section 5 (a) shall be made for each increase of $\frac{1}{8}$ inch in thickness above $\frac{3}{4}$ inch, to a minimum of 18 per cent.

(b) For structural steel under $\frac{5}{16}$ inch in thickness, a deduction of 2.5 from the percentage of elongation in 8 in. specified in Section 5 (a) shall be made for each decrease of $\frac{1}{16}$ inch in thickness below $\frac{5}{16}$ inch.

7. (a) The test specimen for plates, shapes and bars, except as specified in Paragraphs (b) and (c), shall bend cold through 180 degrees without cracking on the outside of the bent portion, as follows: For material $\frac{3}{4}$ inch or under in thickness, flat on itself; for material over $\frac{3}{4}$ inch to and including $1\frac{1}{4}$ inch in thickness, around a pin the diameter of which is equal to the thickness of the specimen; and for material over $1\frac{1}{4}$ inch in thickness, around a pin the diameter of which is equal to twice the thickness of the specimen.

(b) The test specimens for pins, rollers and other bars, when prepared as specified in Section 8 (c), shall bend cold through 180

degrees around a 1 inch pin without cracking on the outside of the bent portion.

(c) The test specimen for rivet steel shall bend cold through 180 degrees flat on itself without cracking on the outside of the bent portion.

8. (a) Tension and bend test specimens shall be taken from rolled steel in the condition in which it comes from the rolls, except as specified in Paragraph (b).

(b) Tension and bend test specimens for pins and rollers shall be taken from the finished bars, after annealing when annealing is specified.

Fig. 1.

(c) Tension and bend test specimens for plates, shapes and bars, except as specified in Paragraphs (d), (e) and (f), shall be of the full thickness of material as rolled; and may be machined to the form and dimensions shown in Fig. 1, or with both edges parallel.

(d) Tension and bend test specimens for plates over $\frac{1}{2}$ inch in thickness or diameter may be machined to a thickness or diameter of at least $\frac{3}{4}$ inch for a length of at least 9 inches.

(e) Tension test specimens for pins, rollers and bars over $1\frac{1}{2}$ inch in thickness or diameter may be of the form and dimensions shown in Fig. 2. Bend test specimens

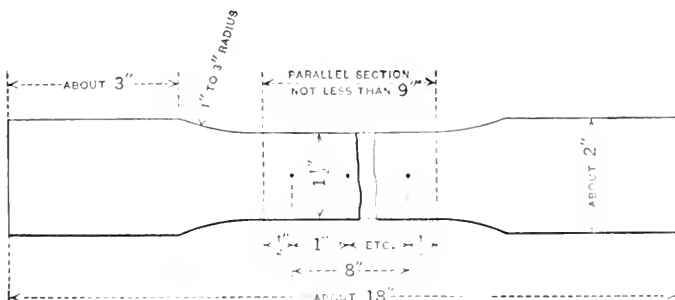


FIG. 1.

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may be 1 by $\frac{1}{2}$ inch in section. The axis of the specimens shall be located at any point midway between the center and surface, and shall be parallel to the axis of the bar.

(f) Tension and bend test specimens for rivet steel shall be of the full-size section of bars as rolled.

9. (a) One tension and one bend test shall be made from each melt; except that if material from one melt differs $\frac{3}{8}$ inch or more in thickness, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

(b) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

(c) If the percentage of elongation of any tension test specimen is less than that specified in Section 5 (a) and any part of the fracture is more than $\frac{3}{4}$ inch from the center of the gage length of a 2 inch specimen or is outside the middle third of the gage

Fig. 2.

length of an 8 inch specimen, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

IV. Permissible Variations in Weight and Gage.

10. The cross-section or weight of each

Thickness Ordered, in.	Nominal Weight, lb. per sq. ft.	
$\frac{1}{8}$ to 5/32	5.10 to 6.37	Under 50 in.
5/32 to 3/16	6.37 to 7.65	10
3/16 to $\frac{1}{4}$	7.65 to 10.20	8.5
$\frac{1}{4}$	10.20	7
5/16	12.75	..
$\frac{3}{8}$	15.30	..
7/16	17.85	..
$\frac{1}{2}$	20.40	..
9/16	22.95	..
$\frac{5}{8}$	25.50	..
Over $\frac{5}{8}$	..	..

V. Finish.

11. The finished material shall be free from injurious defects and shall have a workmanlike finish.

VI. Marking.

12. The name or brand of the manufacturer and the melt number shall be legibly stamped or rolled on all finished material, except that rivet and lattice bars and other small sections shall, when loaded for shipment, be properly separated and marked for identification. The identification marks shall be legibly stamped on the end of each pin and roller. The melt number shall be legibly marked, by stamping if practicable, on each test specimen.

VII. Inspection and Rejection.

13. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector,

piece of steel shall not vary more than 2.5 per cent from that specified; except in the case of sheared plates, which shall be covered by the following permissible variations to apply to single plates:

(a) When Ordered to Weight.—For plates 12 $\frac{1}{2}$ lbs. per square foot or over:

Under 100 in. in width, 2.5 per cent above or below the specified weight;
100 in. in width or over, 5 per cent above or below the specified weight.

For plates under 12 $\frac{1}{2}$ lbs. per square foot:

Under 75 in. in width, 2.5 per cent above or below the specified weight;
75 to 100 in., exclusive, in width, 5 per cent above or 3 per cent below the specified weight;

100 in. in width or over, 10 per cent above or 3 per cent below the specified weight.

(b) When Ordered to Gage.—The thickness of each plate shall not vary more than 0.01 in. under that ordered.

An excess over the nominal weight corresponding to the dimensions on the order shall be allowed for each plate, if not more than that shown in the following table, one cubic inch of rolled steel being assumed to weigh 0.2833 lb.:

Allowable Excess (Expressed as Percentage of Nominal Weight).

For Width of Plate as Follows:				
50 to 70 in., or 70 in. excl.	70 in. or over.	75 to 100 in., excl.	100 to 115 in., excl.	115 in. or over.
15	20	..	..	..
12.5	17	..	..	..
10	15	..	..	..
..	..	10	14	18
..	..	8	12	16
..	..	7	10	13
..	..	6	8	10
..	..	5	7	9
..	..	4.5	6.5	8.5
..	..	4	6	8
..	..	3.5	5	6.5

free of cost, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

14. (a) Unless otherwise specified, any rejection based on tests made in accordance with Section 4 shall be reported within five working days from the receipt of samples.

(b) Material which shows injurious defects subsequent to its acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

15. Samples tested in accordance with Section 4, which represent rejected material, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

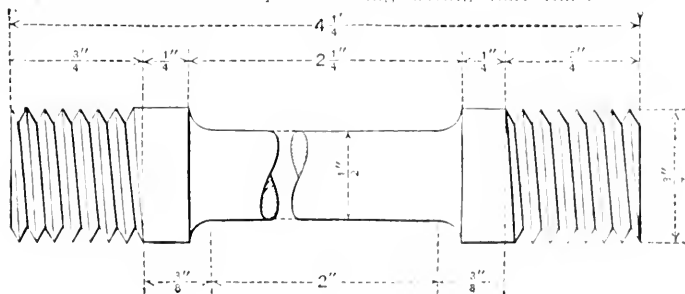


FIG. 2.

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STANDARD SPECIFICATIONS FOR BILLET-STEEL CONCRETE REINFORCEMENT BARS

Serial Designation: A 15—14.

The specifications for this material are issued under the fixed designation A15; the final number indicates the year of original issue, or in the case of revision, the year of last revision.

Adopted, 1911; Revised, 1912, 1913, 1914.*

(1) (a) These specifications cover three classes of billet-steel concrete reinforcement bars, namely: plain, deformed, and cold-twisted.

(b) Plain and deformed bars are of three grades, namely: structural-steel, intermediate and hard.

2. (a) The structural-steel grade shall be used unless otherwise specified.

(b) If desired, cold-twisted bars may be purchased on the basis of tests of the hot-rolled bars before twisting, in which case such tests shall govern and shall conform to the requirements specified for plain bars of structural-steel grade.

I. Manufacture.

3. (a) The steel may be made by the Bessemer or the open-hearth process.

(b) The bars shall be rolled from new billets. No re-rolled material will be accepted.

4. Cold-twisted bars shall be twisted cold with one complete twist in a length not over 12 times the thickness of the bar.

II. Chemical Properties and Tests.

5. The steel shall conform to the following requirements as to chemical composition:

Phosphorus
Bessemer.....not over 0.10 per cent
Open-hearth..... " " 0.05 "

6. An analysis to determine the percentages of carbon, manganese, phosphorus and sulfur, shall be made by the manufacturer from a test ingot taken during the pouring of each melt, a copy of which shall be given to the purchaser or his representative. This analysis shall conform to the requirements specified in Section 5.

7. Analysis may be made by the purchaser from finished bars representing each melt of open-hearth steel, and each melt, or lot of ten tons, of Bessemer steel, in which case an excess of 25 per cent above the requirements specified in Section 5 shall be allowed.

III. Physical Properties and Tests.

8. (a) The bars shall conform to the following requirements as to tensile properties:

Tensile Properties.

Properties Considered.	Plain Bars.			Deformed Bars.			Cold-twisted Bars.
	Structural-Steel Grade.	Intermediate Grade.	Hard Grade.	Structural-Steel Grade.	Intermediate Grade.	Hard Grade.	
Tensile strength, lb. per sq. in. . .	55,000 to 70,000	70,000 to 85,000	80,000 min.	55,000 to 70,000	70,000 to 85,000	80,000 min.	Recorded only.
Yield point, min., lb. per sq. in. . .	33,000	40,000	50,000	33,000	40,000	50,000	55,000
Elongation in 8 in. min., per cent. . .	1,400,000*	1,300,000*	1,200,000*	1,250,000*	1,125,000*	1,000,000*	5
	Tens. str.	Tens. str.	Tens. str.	Tens. str.	Tens. str.	Tens. str.	

(b) The yield point shall be determined by the drop of the beam of the testing machine.

9. (a) For plain and deformed bars over $\frac{3}{4}$ in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 8 (a) shall be made for each increase of $\frac{1}{8}$ in. in thickness or diameter above $\frac{3}{4}$ in.

(b) For plain and deformed bars under $\frac{7}{16}$ in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 8 (a) shall be made for each decrease of $\frac{1}{16}$ in. in thickness or diameter below $\frac{7}{16}$ in.

10. The test specimen shall bend cold around a pin without cracking on the outside of the bent portion, as follows:

Bend-Test Requirements.

Thickness or Diameter of Bar.	Plain Bars.			Deformed Bars.			Cold-twisted Bars.
	Structural-Steel Grade.	Intermediate Grade.	Hard Grade.	Structural-Steel Grade.	Intermediate Grade.	Hard Grade.	
Under $\frac{3}{4}$ in. . . .	180 deg. d = t	180 deg. d = 2t	180 deg. d = 3t	180 deg. d = t	180 deg. d = 3t	180 deg. d = 4t	180 deg. d = 2t
$\frac{3}{4}$ in. or over. . .	180 deg. d = t	90 deg. d = 2t	90 deg. d = 3t	90 deg. d = 2t	90 deg. d = 3t	90 deg. d = 4t	180 deg. d = 3t

Explanatory Note: d—the diameter of pin about which the specimen is bent; t—the thickness or diameter of the specimen.

11. (a) Tension and bend test specimens for plain and deformed bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled; except that the specimens for deformed bars may be machined for a length of at least 9 in., if deemed necessary by the manufacturer to obtain uniform cross-section.

(b) Tension and bend test specimens for cold-twisted bars shall be taken from the finished bars, without further treatment; except as specified in Section 2 (b).

12. (a) One tension and one bend test shall be made from each melt of open-hearth steel, and from each melt, or lot of ten tons,

of Bessemer steel; except that if material from one melt differs $\frac{3}{4}$ in. or more in thickness or diameter, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

(b) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

(c) If the percentage of elongation of any tension test specimen is less than that specified in Section 8 (a) and any part of the fracture is outside the middle third of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

*See Section 9.

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IV. Permissible Variations in Weight.

13. The weight of any lot of bars shall not vary more than 5 per cent from the theoretical weight of that lot.

V. Finish.

14. The finished bars shall be free from injurious defects and shall have a workman-like finish.

VI. Inspection and Rejection.

15. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the bars ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the bars are being furnished in accordance with these specifications. All tests (except

check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

16. (a) Unless otherwise specified, any rejection based on tests made in accordance with Section 7 shall be reported within five working days from the receipt of samples.

(b) Bars which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

17. Samples tested in accordance with Section 7, which represent rejected bars, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

STRENGTH OF MATERIALS.

STRESSES.

A stress' is a force which acts in the interior of a body and resists the external forces which tend to change its shape. Three kinds of simple stress are produced by forces which tend to change the shape of a body.

They are: Tensile, tending to pull apart, as in a rope; compressive, tending to push together, as in a column; shearing, tending to cut across, as in punching a plate.

The **ultimate strength** of a material under tension, compression, or shear, is the greatest unit-stress to which it can be subjected. This occurs at or shortly before rupture, and its value is very different for different materials; thus if a bar whose cross-section is A breaks under a tensile stress, P , the ultimate tensile strength of the material is $P \div A$.

When a small stress is applied to a body a small deformation is produced, and on the removal of the stress the body springs back to its original form. For small stress material, then may be regarded as perfectly elastic.

Under smaller stresses the deformations are approximately proportional to the forces, or stresses, which produce them, and also approximately proportional to the length of the bar or body.

When the stress is great enough a deformation is produced which is partly permanent, that is, the body does not spring back entirely to its original form on removal of the stress. This permanent part is termed a set. In such cases the deformations are not proportional to the stresses.

When the stress is greater still the deformation rapidly increases and the body finally ruptures.

A sudden stress, or shock, is more injurious than a steady stress or than a stress gradually applied.

The **elastic limit** is that unit-stress at which the permanent set is first visible and within which the stress is directly proportional to the deformation. For stresses less than the elastic limit bodies are perfectly elastic, resuming their original form on removal of the stress.

The **working strength** of a material is that unit-stress to which it is, or is to be, subjected. For safety, this must not be greater than the elastic limit of the material used. It should be considerably less to allow for possible defects, usually taken at from one-third to two-thirds the average elastic limit.

Factor of safety for a body under stress or for a piece to be designed is the ratio of the ultimate strength to the working, or the proper allowable working, strength.

Fundamental principles of engineering design are stability and economy: First, the structure must safely withstand all the stresses which are to be applied to it; second, the structure must be built and maintained at the lowest possible cost.

The second of these fundamental principles requires that all parts of the structure should be of equal strength in proportion to the loads which they are required to carry.

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CHICAGO

LOCATION OF HARDPAN IN RELATION TO CITY DATUM

Note: We present the following records of borings taken from the reports on file at the Chicago Academy of Science by representatives of the Western Society of Engineers. To use this table for determining the probable depth of hardpan below the surface, find the East and West street nearest the location of site; then in the table under that street heading trace down to the nearest North and South street to proposed site, where read record of nearest recorded information as to depth of soil suitable for heavy foundation. This process may be repeated for different locations in the vicinity to determine the general lay of hardpan. We understand that most of this data has been accumulated by the Academy of Science from the records of borings made for existing structures, including track elevations and buildings.

ADAMS ST. Feet		CARROL ST. Feet		DIVERSEY AVE. Feet		EMILY ST. Feet	
Michigan Ave. Gas Bldg.	-87.2 & -89.3	N. Elizabeth St.	-107	Sedgwick St.	-25.0	Wood St.	-52.3
Michigan Ave.	-95	CASTELLO AVE.		North Branch	-37.0	ERIE ST.	
State St.	-87	Central Park Ave.		Water pipe Tunnel	-58.1 W. side	Morgan St.	-63
Clark St. about.	-90	CEDAR ST.		DIVISION ST.		N. 48th Ave.	+17.5
Clark St. Am. Trust & Sav. Bldg.	-89.6 & -87.2	State St.		Sedgwick St.	-84.0	EWING PLACE.	
LaSalle St. about.	-90	CUELTHENHAM PL.		C. N. W. Ry.	-69.0	Hoyne Ave.	-58
LaSalle St. Corn Ex Bank.	-85.2 & -90.11	In lake going out to one mile from		Bliss St.	-58	FIFTEENTH ST.	
Market St.	-92	-13, -11, -22, -25, -23, -29 & -6		Hickory Ave.	-54	Wabash No. 1532	
N. Central Park Ave.	-32	CHICAGO AVE.		Noble & Currier St. between	-54	Probably old No.	-68
Forty-first Ave.	0	N. branch of River.		Lawndale Ave.	+13.0	Blue Island Ave.	-41.6
Forty-third Ave.	8	The River		EDGEWOOD AVE.		Blue Island Ave.	-43
Forty-fourth Ave.	7	Halsted St. Bridge south pier		Humboldt Blvd.	+13	S. Central Ave.	-20
ARBOR PL.		N. 40th Ave.		EIGHTEENTH ST.		FIFTY-FIRST ST.	
Union Park Ct.		N. 44th Ave.		Tunnel under south branch -47.0 both sides		3/4 of a mile in lake-18.3	
ARCHER AVE.		N. 47th Ave.		Bridges East		Foot of. ....5 feet in lake	
Commonwealth Edison		N. 48th Ave.		and west		Going out in lake.	
.....-45.0 E. Shaft		CHICAGO TERRACE.		River		St. Lawrence Ave.	
.....-49.0 West		N. 40th Ave.		Loomis		FIFTY-FOURTH ST.	
Halsted St.		N. 44th Ave.		Western Ave.		Ft. of	
Throop St. & C. & A. tracks		N. 47th Ave.		Campbell Ave. 150 ft. S. of S. line of 18th St.		FIFTY-FOURTH PL. (Extended.)	
S. Branch, E. dock.		N. 48th Ave.		Campbell Ave. 200 ft. S. of S. line of 18th St.		In lake	
ARMITAGE AVE.		CHICAGO TERRACE.		EIGHTY-FIRST ST.		FIFTY-SIXTH ST.	
N. Kedzie Ave.		N. 40th Ave.		In Lake going out to one mile off.		2 1/4 miles and coming in -27, -27, -31, -31, -26, -25, -26, -27.3, -29, -24, -28, -26, -28.3.	
N. Sawyer Ave.		N. 44th Ave.		-22.6, -17, -10, -20, -24, -13.8 -8, -6, -13, -23.6, -23.6.		In lake	
Central Park		N. 47th Ave.		Ontario Ave.		South of 56th St.	
AUGUSTA ST.		N. 48th Ave.		Coles Ave.		FILLMORE ST.	
Paulina St.		CHICAGO TERRACE.		Commercial Ave.		S. Central Pk. Ave.	
Met. El. R. R.		N. 40th Ave.		Muskegon Ave.		FORQUER ST.	
N. 47th Ave.		N. 44th Ave.		Sherman Ave.		Blue Island Ave.	
AUSTIN AVE.		N. 47th Ave.		Manistee Ave.		FORTIETH ST.	
N. Rockwell St. & C., M. & St. P.		N. 48th Ave.		EIGHTY-THIRD ST.		Stewart Ave.	
BELDEN AVE.		CHICAGO TERRACE.		In Lake going out to 3/4 miles off.		Lowe Ave.	
Spaulding near Belden		N. 40th Ave.		-20, -22, -24, -22.6		Emerald Ave.	
Central Ave.		N. 44th Ave.		Buffalo Ave.		Western Ave.	
BELMONT AVE.		N. 47th Ave.		Ontario Ave.		FORTY-FIRST ST.	
N. Brnch. of River.		N. 48th Ave.		Bond Ave.		Langley Ave.	
BLOOMINGDALE AVE.		CHICAGO TERRACE.		Coles Ave.		In lake between 40th & 41st Sts.	
Dickson Ave.		N. 40th Ave.		Commercial Ave.		-15, -12, -15, -12	
Ashland Ave. C., M. & St. P. R. R.		N. 44th Ave.		Sherman Ave.		FORTY-SECOND ST.	
Ashland Ave.		N. 47th Ave.		Western Ave.		In lake 5 blocks off	
N. Winchester Ave.		N. 48th Ave.		EIGHTY-SIXTH ST.		-25, -23 & 13	
N. Western Ave.		CHICAGO TERRACE.		1/2 mile off.		FORTY-SECOND PL.	
Kimball Ave.		N. 40th Ave.		ELDRIDGE PLACE		In lake off.	
BRIGHAM ST.		N. 44th Ave.		Michigan Ave.		-13 & -19	
Ashland Ave.		N. 47th Ave.		State St.			
N. Wood St. & Milwaukee Ave.		N. 48th Ave.					

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Manufacturers of

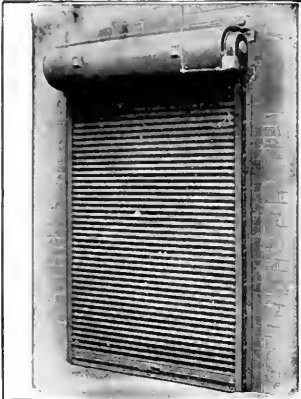
**Steel Fire Doors, Art Metal Doors,
Rolling Steel Shutters, Tin Clad Fire Doors,
Cross Horizontal Folding Doors,
Freight Elevator Doors (Underwriters Label)**

Carroll and Sacramento Aves.

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CHICAGO, ILLINOIS

PHONE KEDZIE 3434



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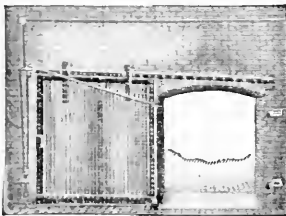
STEEL AND WOOD ROLLING
DOORS AND SHUTTERS
APPROVED FIRE DOORS

The Kinnear Mfg. Co.

1860 Continental and Commercial Bank Bldg.

Phone Wabash 6474

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SAINO FIRE DOOR & SHUTTER COMPANY

Standard Automatic Sliding or Swinging
Fire Doors for protection of openings
in division or fire walls, stairways, etc.

*Our doors are tested and labeled by the Under-
writers' Laboratories, Inc., under the direction
of the National Board of Fire Underwriters*

Equipped with Fixtures, Hangers, Track, Fusible Links, Etc.

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CHICAGO

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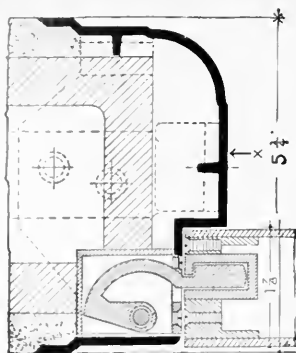
. . . . STEEL TOWERS
AND STRUCTURAL STEEL FOR BUILDINGS

WENDNAGEL CO.

3 Phones CANAL 2140

CHICAGO

FORTY-THIRD ST.		HARRISON ST.		JOHNSTON AVE.		Feet	
Lake Ave.	-43.0	State se. corner....	-58	Humboldt Blvd. ..	+10.2	Homan Ave.	-40
FORTY-FOURTH ST.		State St.	-81.0	KINZIE ST.		St. Louis Ave.	-40
State St.	-58.0	Federal St. (Ex-		State St.	-114	40th Ave.	-6
FORTY-SIXTH ST.		change).—77 to —82		Centre Ave.	-70	NELSON ST.	
150 ft. east of shore—	11.0	Fifth Ave.	-84	Ann St.	-78	Western Ave.	-40
C. St. L. & P. R. R.—	38.0	Bridges east	-79.1	Campbell Ave. RR.		NINETEENTH ST.	
S. Leavitt St.	-38	West	-81.1	bridge north....	-35.0	Wentworth Ave. ..	-68
		Springfield Ave. ..	-36.0	South	-45.0	Washenaw Ave.	-56.4
		44th Ave. & Colo-		40th Ave.	+3	Wasanaw Ave. 90	
		rado Ave.	-38			ft. N. of S. line	
						of 19th St.	-54.0
FORTY-SEVENTH ST.		HARVARD ST.		LAKE ST.		NINETY-FIRST ST.	
In Lake 2 1/4 miles		Homan Ave.—56.0 & 60.0		River	-98	Under Grand Calu-	
from foot of 47th		Central Pk. Ave.	-51	Halstead St.	-69.0	met River.	
St. and proceed-				Ashland Ave.	-63	....—66.0 east & west	
ing to shore....						Kingston Ave.	-10
—25, —20, —19, —20,						Essex Ave.	-15
—25, —20, —25, —24,						Phillips Ave. east side	0
—25, —25, —9, —19 &						Phillips Ave. west	
—16.						side of	+5
FORTY-NINTH ST.		HIRSCH ST.		LYDIA ST.		Yates Ave.	+10.0
600 ft. east of shore	-9.0	Rockwell St.	-43.5	Union St.	-93	Stoney Island Ave. ..	0
In lake off.	-9	Washenaw Ave.	-46.9			NINETY-SECOND ST.	
		California Ave.	-51.7			Stoney Island Ave. ..	-5
FOURTEENTH ST.		HOMER ST.		NORTH BRANCH ST.		NINETY-SECOND PLACE	
Michigan Ave.	-82	Rockwell	-31	Larrabee St. at So.		Stoney Island Ave. ..	+8
Centre Ave.	-42			side of N. Branch			
Fifty-Second Ave. ..	-29			St.	-86		
FRONT ST.		HARMON CT.		Larrabee St. n. side			
Halsted St. S. Brch.		Michigan Ave. 4		of N. Branch....	-85		
Chgo river	-40.0	mile tunnel	-72				
FULLERTON AVE.		Wabash Ave. nw.		LAWRENCE AVE.			
Clark St.	-57.5	corner	-77	River	-21.0		
Sedgwick St.	-57.0	Wabash Ave. nw. cor-					
Cleveland	-50	ner	-73.5				
Larrabee St.	-25	Wabash Ave.					
Larrabee & Cleve-		.....	-72.11 & 74.11				
land between	-25						
Halsted St.	-28.0						
N. Branch	-19.0						
Triangle at Cooper—	65						
River 100 ft. north							
of Fullerton Ave.							
bridge in the river—	21						
River 800 ft north							
of Fullerton Ave.							
bridge in the river—	17						
River 500 ft. north							
of Fullerton Ave.							
bridge in the river—	18						
Humboldt Blvd.	+9						
Humboldt Blvd.	+7						
Kedzie Ave.	+9.0						
Springfield Ave. ..	-4.0						
FULTON ST.							
Canal nw. corner....	-102						
Canal se. corner....	-87						
Peoria St.	-99.0						
Oakley Ave.	-55						
Rockwell	-45						
GARFIELD AVE.							
Clybourn Ave. north							
of C.M.&St.P. RR.—	98						
Clybourn Ave. south							
of C.M.&St.P. RR.							
station	-107						
GRANT PLACE.							
Sedgwick St.	-82						
GRAND AVE.							
River near (Bould-							
ers)	-80						
Desplaines St.	-107						
GRACE ST.							
Western Ave.	-41						



Section 1320 For 4-in. Tile

J. G. BRAUN

ROLLED WROUGHT IRON DOOR FRAMES

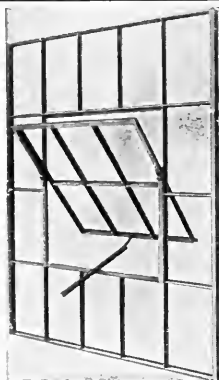
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UNDER THE DIRECTION OF
THE NATIONAL BOARD OF FIRE UNDERWRITERS

PATENT INVISIBLE HINGES

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609-621 South Paulina St.
Telephone West 713

NEW YORK OFFICE
537-541 West 35th Street
Telephone 2540 Greeley

Catalogue on Application



American Steel Window Co.

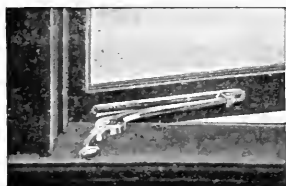
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ROLLED STEEL WINDOWS

McCormick Bldg., CHICAGO

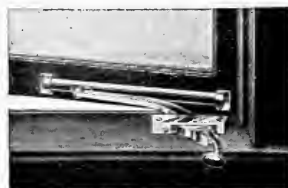
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Factory: CHICAGO HEIGHTS, ILL.



Security Casement Adjuster
Made only in iron, any finish

PERMIT me to send
you detailed information
so that you may obtain the
best Casement Adjusters for
out swinging windows, at
all prices.



Wilkins Casement Adjuster
Made only in Brass and Bronze

George Lester Wilkins

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FEDERAL
Steel Lockers
and Shelving
*are made right
and priced moderately*

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FEDERAL STEEL LOCKERS

Features Special Lockers of special shape and
size, having equipment suitable for Schools,
Armories, Fire Houses, Golf Clubs, Mines,
Garages. etc.

*It will help the Architects to specify
Ask for a copy*

Federal Steel Fixture Co.
CHICAGO



ONE HUNDRED
TWENTY-SEVENTH ST. Feet
C. E. I. R. R.-65.0

ONTARIO ST.
Orleans St.-98
48th Ave.-14.5

PALMER AVE.
Humboldt Blvd. ..+10
Humboldt Blvd. ..+8

PARK AVE.
Wood St.-60

PECK CT.
Wabash Ave.-80

PETERSON ST.
Hoynes Ave.-51

POLK ST.
Federal St.-82
Bridge East -80.2
& west-77.5
Rockwell-38
Springfield Ave. ..-41

QUINCY ST.
State north of
Quincy-63
Market St.-86

RANDOLPH ST.
Wabash Ave. about.-90
Bridge east.....-75.9
Jefferson St.-86
Beaubien Ct.-86

READ CT.
Middle of Read Ct. +5

RICE ST.
Western Ave.+10
Oakley Ave.+10
Kedzie Ave. &
Bloomingtonale ...-2.0

SEVENTEENTH ST.
Robey St. 145 ft.
N. of N. line of
17th St.-5.1
Robey St. 640 ft.
N. of N. line of
17th St.-28.5

SEVENTIETH ST.
In lake off.....-12

SEVENTY-FIRST ST.
Coles Ave.-55
Oglesby Ave.-59.0
Lake Shore-56.0

SEVENTY-SECOND ST.
Coles Ave.-47
Oglesby Ave.-52.0

SEVENTY-THIRD ST.
Crib, Edw. Dunne.-101
In Lake off.....-13.6
Bond Ave.-52
Coles Ave.-56.2
Oglesby Ave.-48.0
Constance Ave.-45
Ellis Ave.-31
Drexel Ave.-49
State St.-51

SEVENTY-FOURTH PL.
Railroad Ave.+5

SEVENTY-FIFTH ST. Feet
Saginaw Ave.0
Yates Ave.-0.0

SEVENTY-SIXTH ST.
In Lake off.....-13
Saginaw Ave.0
Colfax Ave.0

SEVENTY-SIXTH PL.
Sherman Ave.0

SEVENTY-EIGHTH ST.
In Lake off.....-17.6
In Lake off.....-22

SEVENTY-NINTH ST.
In Lake going out
one mile off....
-16, -20, -20, -22,
-22, -23.0, -20, -22,
and -25.
Ontario Ave.+1.5
Escanaba Ave.-4.0
Muskegon Ave.-3.0
State St.-36

SIXTEENTH ST.
State-54.0
Dearborn St.-73
Clark St.-52
Grove St. S. Branch
Chicago River...-25.0

Union St. 100 ft.
N. of N. line of
16th St.-37.9
Union St. 200 ft.
N. of N. line of
16th St.-38.4

Halsted St. 0 ft. N.
of N. line of 16th
St.-34.7
Halsted St. 200 ft.
N. of N. line of
16th St.-39.1

Newberry Ave. 0 ft.
N. of N. line of
16th St.-33.0
Newberry Ave. 200
ft. N. of N. line
of 16th St.-38.0

Johnson St. 0 ft. N.
of N. line of 16th
St.-34.0
Peoria St. 200 ft.
N. of N. line of
16th St.-44.7

Sangamon St. 0 ft.
N. of N. line of
16th St.-30.9
Sangamon St. 200
ft. N. of N. line
of 16th St.-43.4

Morgan St. 0 ft. N.
of N. line of 16th
St.-41.5
Morgan St. 200 ft.
N. of N. line of
16th St.-44.9

Center Ave. 0 ft.
N. of N. line of
16th St.-57.0
Center Ave. 150 ft.
N. of N. line of
16th St.-50.0

Blue Island Ave.
0 ft. N. of N.
line of 16th St.-17.2
Blue Island Ave.
150 ft. N. of N.
line of 16th St.-38.8

Feet
Throop St.-89
Loomis St. 0 ft. N.
of N. line of 16th
St.-29.1
Loomis St. 140 ft.
N. of N. line of
16th St.-28.0

Lafin St. 0 ft. N.
of N. line of 16th
St.-22.0
Lafin St. 140 ft. N.
of N. line of 16th
St.-23.7

Ashland Ave. 0 ft.
N. of N. line of
16th St.-4.2
Ashland Ave. 140 ft.
N. of N. line of
16th St.-8.0

Paulina St. 0 ft. N.
of N. line of 16th
St.-18.0
Paulina St. 145 ft.
N. of N. line of
16th St.-16.1

Wood St. 0 ft. N.
of N. line of 16th
St.-17.5
Wood St. 145 ft.
N. of N. line of
16th St.-16.2

Lincoln St. 0 ft. N.
of N. line of 16th
St.-4.0
Lincoln St. 200 ft.
N. of N. line of
16th St.-14.6

Forty-fourth Ave.-37.0

SIXTIETH ST.
Stony Island Ave.-75

SIXTY-THIRD ST.
Stony Isl. Ave. east.-79.0

SIXTY-SIXTH ST.
In Lake south of...-11

SIXTY-SEVENTH ST.
Langley Ave.-95.0

SIXTY-EIGHTH ST.
Crib Borings:
5000 ft. from shore.-60.0
5800 " " " -60.2
8400 " " " -61.6
10300 " " " -69.4
11100 " " " -103.0
Oglesby Ave.-60.0

SOUTH WATER ST.
Wabash Ave.-114.0
State St. Bridge:
South-69.0
North-71.9
Dearborn St. Bridge:
East-95.0
West-105.0
Dearborn St. River.-102
Dearborn St. River.-102.6

SUPERIOR ST.
Rockwell-10
48th Ave.-11.8
49th Ave.-16

TAYLOR ST.
Clark St.-68
Federal St.-80
Springfield Ave.-43

THIRTY-FIRST ST. Feet
Cottage Grove Ave.-55.0
C. R. I. & R. R. R.-27.0
Stewart Ave.-27
Lowe Ave.-11
Morgan St.-3
Benson St.-32
Ashland Ave. Chi-
cago River near
31st St.-33
S. Fork of S. Branch.-32.0

THIRTY-SECOND ST.
48th Ave.+15

THIRTY-THIRD ST.
Halsted St.-26
Lowe Ave.-22
Aubourn St.-20

THIRTY-FIFTH ST.
At Pier off.....+2
Vernon Ave.-50
Michigan Ave.-37.1
Canal St.-37
Halsted St.-25.7
Centre St.-28
Western Ave.-12.0
48th Ave.-75
Under S. Fork of S.
Branch:
East Side-27.0
West Side-28.0

THIRTY-SIXTH ST.
Union Ave.-27
Western Ave.-7.0

THIRTY-SIXTH PL.
Michigan Ave.-41

THIRTY-SEVENTH ST.
State St.-92
Wentworth Ave.-42
Stewart Ave.-21
Union Ave.-23
Morgan St.-25

THIRTY-SEVENTH PL.
Halsted St.-27

THIRTY-EIGHTH PL.
At Lake-58

THIRTY-NINTH ST.
Wabash Ave.-20
Wabash Ave.-28
State St.-30.0
Dearborn St.-31
Wentworth Ave.-18.5
Stewart Ave. south
of-34.5
Stewart Ave.-24.5
P. F. T. W. & Cr. R.-25.0
Union Ave.-24
Emerald Ave.-30
Emerald Ave.-29.7
Halsted St.-21
Ashland Blvd.-28
Western Ave.-35.0
Centre Ave. and Riv-
er (Ship)-22.0

THOMAS ST.
Lincoln St.-48.7
Western Ave.+5
Lawndale Ave.+10

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Automatic Iron and Copper Window Frames and Sashes for Wire Glass

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Slate, Tin, Tile and Corrugated Iron Roofing :: Metal Cornices and Skylights

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A. K. KNISELY, Treas.

J. O'REILLY, Sec'y

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Hardware Approved and Accepted by the Underwriters' Laboratories with Their Labels Attached

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Sheet Metal Works

Galvanized Iron and Copper Cornices, Sky Lights, Slate, Tile, Tin and Corrugated
Iron Roofing, Metal Fire Windows, General Jobbing

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**SKYLIGHTS, GUTTER AND SHEET METAL WORK
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Advance Roofing & Sheet Metal Works

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"AMCO" CONVEYING MACHINERY

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**Gravity Conveyors, Spiral Chutes, Roller Spirals, Belt Conveyors,
Power Conveyors, Automatic Incline and Vertical Elevators,
Ash Hoists and Other Conveying Equipment**

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We specialize in Designing Special
Machinery to Meet Special Conditions

General Offices and Factory, Dept. M, ST. LOUIS, MO.

New York Boston Detroit Los Angeles CHICAGO, 647 Webster Bldg. Tel. Harrison 7356

Feet

our Mile Tunnel at Michigan Ave. & I. C.—78
 Humboldt Park Center of—48.0
 Calumet River Bridge at old N. Channel between 111th & 114th St.—14
 Sixty-eighth Ave. at Oak Park—33
 Wis. Cent. R.R. and Central Pk. Ave.—36
 Park Row and 2½ Mile Crub (Boring)—
 Shore Shaft:
 2500 ft. from shore—77.0
 5000 ft. from shore—85.0 & —90.0
 7500 ft. from shore—96.0
 10000 ft. from shore—100.0
 12800 ft. from shore—107.0
 E. Side of Goose Island at N. Pier of Halsted St.
 Bridge near E. Side of Goose Island..—60
 E. Side of Goose Island at N. Pier of Halsted St. Bridge—60
 Court House and City Hall—97.0 to —103.0
 Fisk St. Commonwealth Edison ..—48.0 north shaft.
 Humboldt Blvd. at Caltaipia Ave. ..+75
 Humboldt Blvd. and N. Branch—37.0
 Humboldt Ave. at Humboldt Blvd...+10
 Ashland Ave. W. Arm S. Fork S. Branch Excav. did not reach rock.
 Sheridan Rd. at the Canal—59.8
 Millard Ave. at Colorado Ave. 3%
 E. North Water St.—94
 W. Western Ave. Humboldt Blvd. (N. Sacramento) —25
 Montrose Ave. & N. Branch —37.2 west & 38.5 east.
 Windsor Ave. at Elliot Ave.—31
 Austin Ave. & N. Morgan St.—77
 Center Ave. & Sedgwick St.—82.0
 N. Branch & N. Western Ave.—36.0 north and —45.0 south
 Ogden Ave. at Clyde Ave.—37
 Kinzie St. at Cuyler Ave.—40

Emerald Ave.—24

41st Ave. —2

Specifications KEWANEE Water Heating Garbage Burners

	TYPE A				TYPE D								TYPE H				
	30	31	32		34	35	36	37	38	39	40		41	42	43	44	45
Catalog Number.....	Gay	Gaze	Gear		Gain	Gale	Gunny	Gang	Gap	Garb	Gash		Gait	Game	Gasp	Germ	Gift
Capacity, gallons per hour, 50 degree raise.....	200	300	400		500	600	800	1000	1200	1500	1800		1200	1500	1800	2200	2600
Capacity, garbage chamber one charge, bushels....	1	2	3		2	3	4	5	7	9	12		6	8	9	11	12
Height over all, inches.....	58	64	64		56	56	56	56	56	56	56		69	69	69	71	71
Diameter of floor space required, inches.....	22	25	30		29x29	29x35	35x35	35x41	35x47	41x53	41x59		38x36	38x42	38x48	38x54	38x60
Height to bottom of front garbage door, inches....	33	37	37		32	32	31	31	31	31	31		37	37	37	37	37
Dimensions of garbage door, inches.....	7x8	7x8	7x8		14x16	14x16	16x16	16x16	16x16	16x16	16x16		16x16	16x16	16x16	16x16	16x16
Dimensions of coal or fire door, inches.....	7x8	7x8	7x8		14x10	14x10	16x10	16x10	16x10	16x10	16x10		16x8	16x8	16x8	16x8	16x8
Diameter of coal or lower grates, inches.....	12	16	20		18x18	18x24	24x24	24x30	24x36	30x42	30x48		24x24	24x30	24x36	24x42	24x48
Size, flow and return flanges, two each, inches.....	1½	2	2		2	2	2½	2½	2½	3	3		3	3	4	4	4
Diameter of smoke pipe, inches.....	6	8	8		9	9	10	10	10	12	12		10	10	10	12	12
Approximate shipping weight, pounds.....	600	800	1000		1600	1800	2100	2300	2500	3000	3300		2800	3100	3400	3700	4000

One full charge of garbage can be completely destroyed on an average in one hour.

We recommend that circulating mains and branches be covered in large installations.

Best results are obtained when capacity of water storage tank is 50 per cent greater than hourly capacity of the garbage burner to which it is attached.

KEWANEE BOILER COMPANY

KEWANEE, ILLINOIS

Branches: Chicago, St. Louis, New York, Kansas City, Salt Lake City
Steel Heating and Power Boilers, Radiators, Tanks, Garbage Burners

Specifications KEWANEE Smokeless Firebox Boilers

These boilers will heat all the radiation shown by their capacity

Number.....	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Capacity, Steam, square feet.....	1600	1900	2200	2500	2900	3300	3800	4400	5000	5800	7000	8200	9500	10500	12000	13000	15000
Capacity, Water, square feet.....	2600	3100	3600	4100	4700	5300	6200	7200	8200	9500	11400	13400	15500	17000	19600	21000	24500
Diameter Boiler.....inches	36	36	36	42	42	42	48	48	48	54	54	60	60	66	66	72	72
Length Boiler over all.....feet inches	8-7	10-2	11-7	9-10	11-4	12-11	12-4	13-10	15-4	15-10	18-4	17-10	20-4	18-4	20-4	18-4	20-4
Width of firebox.....inches	30	30	30	36	36	36	42	42	42	48	48	53	53	59	59	65	65
Length of firebox.....inches	45	51	57	54	60	66	66	72	78	78	84	90	96	90	96	96	102
Heating Surface.....square feet	182	213	249	252	291	335	387	419	492	580	692	735	862	968	1092	1155	1310
Square feet of Steam capacity as rated for each square foot of heating surface.....	8.8	8.9	8.8	9.9	9.9	9.9	9.8	9.8	10.0	10.0	10.1	11.1	11.0	10.8	11.0	11.2	11.4
Area of upper grate.....square feet	5.8	7.1	8.3	8.5	10.0	11.3	11.7	13.1	14.9	17.0	19.0	21.0	23.2	23.4	25.8	28.4	31.1
Square feet of heating surface for each square foot of grate.....	31	30	30	30	29	30	33	34	33	34	36	35	37	41	42	40	42
Diameter of Breeching.....inches	20	20	22	22	22	24	24	27	27	30	30	34	34	36	36	38	38
Diameter of Stack.....inches	18	18	20	20	20	22	22	24	24	28	28	32	32	34	34	36	36
Minimum height of Stack.....feet	40	40	40	50	50	50	50	55	55	60	60	60	60	70	70	70	70
Diameter of Stack for two Boilers.....inches	..	..	..	26	28	30	30	32	32	34	36	38	38	40	42	44	46
Minimum height of Stack for two Boilers.....feet	..	..	..	60	60	60	60	60	60	70	70	70	75	75	80	80	80
Size of Steam opening (one).....inches	5	6	6	6	6	6	6	6	7	7	7	7	7	8	8	8	8
Size of Return (one).....inches	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6
Size of Safety Valve.....inches	2	2	2	2½	2½	2½	2½	2½	3	3	3	3½	3½	3½	3½	4	4
Number and size of Supply and Return openings for Water.....inches	2-5	2-5	2-6	2-6	2-6	2-6	2-6	2-7	2-7	2-7	2-7	2-8	2-8	2-10	2-10	2-10	2-10
Height of Water line.....inches	55	55	55	58	58	58	61	61	61	66	66	75	75	80	80	85	85
Height from floor to top of brick work.....inches	76	76	76	82	82	82	89	89	89	95	95	107	107	113	113	119	119

Kewanee Smokeless Boilers also manufactured in Portable Type

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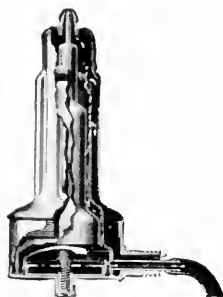
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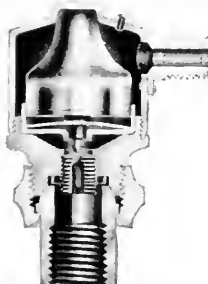
No. 4 Hoffman
Junior Quick
Vent Air
Valve



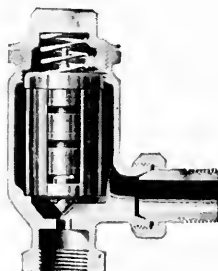
No. 2 Hoffman
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Vacuum Valve



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No. 3 Hoffman
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No. 8 Hoffman
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CHICAGO

HEATING AND VENTILATION

Edited by FRED J. POSTEL, Mech. Engr.

HEATING.

It is safe to say that in the majority of cases where the installation of a heating system is under consideration, the architect or engineer has a reasonable doubt as to whether he should install a steam or hot water system. It may be well, therefore, to consider some of the advantages and disadvantages of the two systems. In this comparison the simple gravity heating system is the one referred to.

Generally speaking, the advantage of the steam over hot water is lower first cost, smaller radiators and smaller piping. The principal disadvantage is the fact that the temperature of the radiating surface cannot be regulated to meet the demands of the weather conditions. Again, the system is operative only so long as there is pressure in the mains. If the pressure is allowed to fall to atmosphere, circulation ceases, and the building is, to all intents and purposes, without a heating system, even though there is a smoldering fire in the furnace.

The advantage of the hot water heating system is that the temperature of the water may be varied with the demands of the service. With a properly designed system the water circulates at a very low temperature, so that a smoldering fire will produce sufficient circulation in mild weather. This feature makes it possible also to continue heating the building after the fires have been banked for the night.

The principal disadvantages of a hot water system are the greater first cost, larger radiators and piping, and the ever present possibility of damage to decorations and furnishings, as a result of a leak in the system.

Numerous attempts have been made with varied success to overcome the disadvantages of both systems, but so far as I have found, none of these solve the problem for all conditions.

To provide for temperature regulation in a steam system two general systems have been brought out. One depends on throttling down the steam and discharging only enough into the radiator to provide the heat required. The other depends on air binding a certain number of loops in the radiator and operating the remaining loops at full pressure. The latter, of course, can be used only where compressed air is available and is used in connection with an automatic system of temperature regulation.

To overcome the disadvantage of large, ungainly radiators and piping in hot water systems, various devices have been used to increase the temperature of the water under conditions of extreme demand. These systems depend on increasing the pressure on

the water above atmosphere, and are what may be referred to as closed systems, either wholly or in part.

STEAM HEATING.

In designing a system of steam heating, it should first be determined whether the conditions will be best met by a gravity, or a vacuum system.

In a gravity system, the mains and radiating surface are so laid out that all condensation returns to the boiler by gravity and no machinery is required to keep the system in operation. This system is necessarily operated at a pressure above atmosphere so that the pressure in the radiators is sufficient to expel the air from the system.

A vacuum system may be either a "dry" or "wet" system. In the dry system a vacuum is maintained on air valves which are intended to handle air only. In a wet system the condensation and the entrained air are removed through the same pipe.

There are a number of modifications of these two systems, but broadly speaking, all steam systems may be classed either as "gravity" or as "vacuum" systems.

In determining whether the expense of a vacuum system is justified by the conditions, the advantages to be obtained by using it must be carefully considered. The two things which make a vacuum system better than a gravity system are, first, circulation at a lower pressure; second, quick circulation when new radiation is turned on. The former is of particular importance in cases where the exhaust steam from engines is used to heat the building. The efficiency of the engine is increased as the back pressure is decreased. Therefore, the use of a vacuum system may be the means of saving considerable coal. On the other hand, the installation of a vacuum system cannot be justified from the standpoint of economy in coal consumption, if the demand for exhaust steam is so heavy that live steam must be used to make up the deficiency, even with the engine running against a back pressure.

Vacuum systems are sometimes installed where there are no engines and where the system might as well operate at 5 lbs. as at $\frac{1}{2}$ lb. back pressure. The net cost of operating such a system is necessarily greater than would be the case in a gravity system and the only advantage is a somewhat freer circulation, and the fact that the radiators will heat up promptly when the inlet valves are opened.

A well laid out gravity system of ordinary

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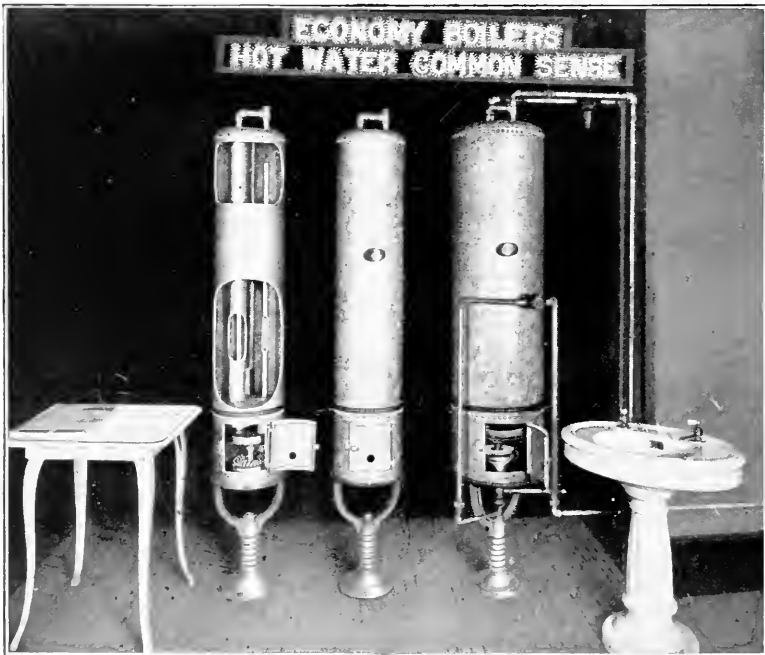
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size should circulate freely with one pound pressure under all ordinary conditions and with not to exceed two pounds pressure in extreme cold weather, when the demand for steam and therefore the velocity of the steam in the pipes reaches a maximum. A vacuum system should not require to exceed one-half pound pressure under any condition.

A gravity system may be either a "one-pipe" or a "two-pipe" system and either of these may be an "up-feed" or a "down-feed" system. Except in the case of very high buildings equally good results can be obtained with either up-feed or down-feed, but where the building is very high there is an advantage in having a down-feed system.

A vacuum system may be either up-fed or down-feed, but will always be a two-pipe or a three-pipe system. The wet vacuum system is always necessarily a two-pipe system. The dry vacuum system when used in connection with cast iron radiation is usually a two-pipe system, the vacuum pipe being a very small pipe with probably $\frac{1}{4}$ -inch branches and a main seldom larger than one inch. Where the dry vacuum system is applied to a coil system of heating in which the steam and returns are separate, the vacuum pipe will be required in addition to the other two, thus making a three-pipe system.

Inasmuch as loss of heat from buildings is by radiation and conduction from walls and windows and by the air which must be replaced by new air for ventilation, heating formulae must necessarily involve the quantities, area of exposed wall, area of glass and the cubical contents, the last being in connection with frequency of changes of air.

The loss of heat through walls of buildings depends on the construction and thickness and the materials used, and on the difference of temperature between outside and inside surfaces.

The amount of heat passing through walls, and glass expressed in B. T. U. per hour, per square foot of surface, per degree difference of temperature is approximately:

1/3 B. T. U. for an 8" brick or stone wall.
1/20 B. T. U. for an 8" (solid) wood wall.
1/4 B. T. U. for a 12" brick or stone wall with air space.

1 B. T. U. for a single thickness of glass.
2/3 B. T. U. for a double thickness of glass (air space between).

For ordinary temperatures and pressures 55 cubic feet of air would require 1 British Thermal Unit per degree rise of temperature.

The foregoing, together with the fact that heat emitted from radiating surfaces per square foot, per hour, per degree difference of temperature above that of surrounding air is 1.8 British Thermal Units when radiating surface is 150 degrees above temperature of surrounding air to 1.7 British Thermal Units, when radiating surface is 110 degrees above temperature of surrounding air furnish a basis for estimating the amount of radiating surface required.

There are a great number of heating formulae in use and it is seldom that the results figured by these various formulae will agree. The formulae are all empirical formulae and are based on average conditions. If the conditions of any particular case vary considerably from the average, it is quite likely that none of the formulae will give correct results. For example, if a room with excessive exposure or an un-

usually large amount of glass, or a very large volume and comparatively small amount of glass is figured by one of these formulae, the results are bound to be unsatisfactory.

Allowance must, therefore, always be made with any of the formulae for local conditions and for this reason the writer has always made it a practice to use a factor "C" in all formulae, this factor being dependent upon the local conditions.

A simple formula which is sometimes used, but which is rather crude and not entirely accurate, is as follows:

Heating surface = $\frac{1}{2}$ of net glass area plus $\frac{1}{20}$ of net wall area plus $\frac{1}{200}$ of cubic contents.

Mr. Linn, in his article on this subject in Vol. XIV of the "Hand Book", gives several formulae for calculating the radiating surface, any one of which will be found quite satisfactory. The following is one of these, summarized and reduced to algebraic statement:

W = Gross exterior area less "G" in sq. ft. of exposed walls of the room, for which radiation is to be computed, including area of ceiling where room or space above is not heated.

G = Area in sq. ft. of exterior window and exterior door openings measuring the entire wall opening for window and door-frames of room to be heated.

V = Cubic foot contents of the room to be heated.

L = Factor for lowest recorded exterior temperature. Determine lowest recorded exterior temperature from weather bureau reports, then find "L" in table below corresponding. For Chicago this is -20° , therefore **L** = 1.14, for Chicago.

Lowest recorded temperature for the locality.	L	Lowest recorded temperature for the locality.	L
-45°	1.5	-10°	1.
-40°	1.43	$+0^{\circ}$	.93
-35°	1.36	$+5^{\circ}$	.86
-30°	1.29	$+10^{\circ}$	.79
-25°	1.21	$+15^{\circ}$	.71
-20°	1.14	$+20^{\circ}$	.64
-15°	1.07	$+25^{\circ}$	.57

Q = Radiation required to heat the room to 70° Fah. under average conditions.

C = Factor for local and special conditions exposure, etc., fixed by the judgment of the estimator to cover conditions varying from the average.

T = Factor for thickness of enclosing walls.

T = 10 for walls 8 to 10 inches thick.

T = 15 for walls 12 to 24 inches thick.

T = 20 for walls 26 to 38 inches thick.

M = Factor for method of heating.

M = .0055 for steam heating.

M = .0072 for hot water in radiators 180° .

M = .0081 for hot water in radiators 170° .

M = .0092 for hot water in radiators 160° .

Note—If water is 175 degrees in flow and 145 degrees in return, the average is 160 degrees, and is the temperature which should be expected in radiators under these conditions.

SPECIFICATIONS READING

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Fig. 168
Angle Radiator Valve



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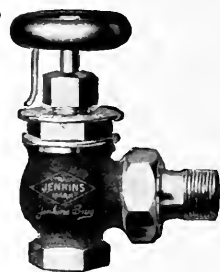


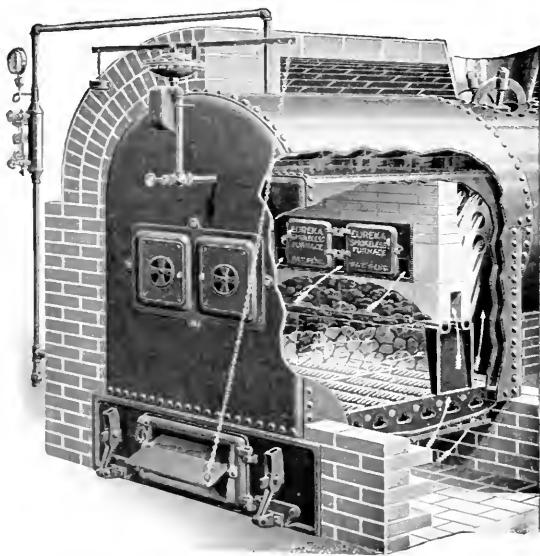
Fig. 300
Fractional Angle Radiator Valve

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Formulae for computing either steam or hot water radiation required in any room in any building in any location:

$$\left[\left(\frac{W}{T} + G \right) 75 + V \right] M = Q \begin{matrix} \text{Average} \\ \text{Radiation} \\ \text{Required} \end{matrix}$$

QC = Special radiation required.

Above formula is based upon using direct radiation and provides for one change per hour. For more frequent changes increase the cubic contents by as many times as it is desired to change the air per hour, the other factors remain the same.

"Direct" radiation is surrounded by warm air, but cold air comes in contact with the surface, in "Direct-indirect" and "Indirect" systems to a greater or less extent; so that for "Direct-indirect" radiation add 25 per cent and for "Indirect" radiation add 50 per cent.

SIZES OF STEAM MAINS.

Radiation	One Pipe		Two Pipe	
	Work		Work	
125 sq. ft.....	1½ in.	1¼ × 1 in.		
250 sq. ft.....	2 in.	1½ × 1¼ in.		
400 sq. ft.....	2½ in.	2 × 1½ in.		
650 sq. ft.....	3 in.	2½ × 2 in.		
900 sq. ft.....	3½ in.	3 × 2½ in.		
1250 sq. ft.....	4 in.	3½ × 3 in.		
1600 sq. ft.....	4½ in.	4 × 3½ in.		
2050 sq. ft.....	5 in.	4½ × 4 in.		
2500 sq. ft.....	6 in.	5 × 4½ in.		
3600 sq. ft.....	7 in.	6 × 5 in.		
5000 sq. ft.....	8 in.	7 × 6 in.		
6500 sq. ft.....	9 in.	8 × 6 in.		
8100 sq. ft.....	10 in.	9 × 6 in.		

HOT WATER HEATING.

In hot water heating the system may be a one-pipe or two-pipe system, or may be a gravity circulation system or a forced circulation system.

The gravity circulation system is dependent for circulation upon the fact that cold water is heavier than hot water. Therefore, the pitch of supply line should be upward from the boiler (which is the reverse of the requirement in steam heating) and the return should pitch downward toward the boiler as is the case, also, in steam heating.

In forced circulation systems which must be used when long horizontal runs are encountered, as is the case in factory heating, where the boiler or source of heat is in a detached power plant, a pump must be employed.

In one-pipe systems the radiators are connected in shunt with the supply lines, that is, the water to a radiator is taken from supply line, passes through radiator and is returned to supply line at a point further along in the direction of the travel of the water. Special fittings are sometimes employed in the diversion of the water into the radiators, especially in the case of forced circulation systems.

Two-pipe systems, especially in gravity circulation systems, may be considered to have more positive circulation.

Either one-pipe or two-pipe, or gravity or forced circulation systems may be closed or open systems, though closed systems are rarely found except in larger forced circulation systems. In either system an expansion tank must be used because of the expansion of water as its temperature rises.

The formulae which are used in estimating the amount of radiating surface required

for steam heating may be used for computing the amount of radiating surface required for hot water heating, providing a factor dependent upon the difference in temperature of the hot water and of the steam is introduced.

SIZE OF HOT WATER MAINS.

(For gravity circulation and low buildings.)

Size of Main	Direct Radiation		Indirect Radiation	
	Will Supply		Will Supply	
Area	Feet	Feet	Feet	Feet
1½ in.	2.03	200	135	
2 in.	3.35	325	200	
2½ in.	4.78	450	300	
3 in.	7.38	700	450	
3½ in.	9.82	900	600	
4 in.	12.73	1200	800	
4½ in.	15.93	1500	1000	
5 in.	19.99	2000	1200	
6 in.	28.88	3000	2000	
7 in.	38.73	4200	2800	
8 in.	50.03	5600	3600	
9 in.	63.63	7000	4600	
10 in.	78.83	8500	5600	

In forced circulation systems it is considered good practice to so proportion mains and returns that velocity of water will not exceed 200 feet per minute.

Carpenter gives as a practical rule, applicable when main and supply do not exceed 200 feet in length, "The diameter of main supply or return pipe in a system of direct hot water heating should be one pipe-size greater than the square root of the number of square feet of radiating surface, divided by 9 for the first story, by 10 for the second story and by 11 for the third story of the building. For indirect hot water, multiply above by 1.5".

BOILERS FOR HEATING SYSTEMS.

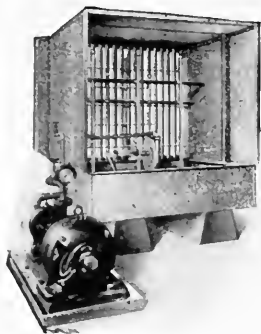
Boilers sold for heating installations are rated by manufacturers in square feet of radiating surface, which they will supply. Comparison of boilers sold by different manufacturers discloses the fact that boilers of different makes, having the same amount of heating surface have widely different ratings, as given by the manufacturers; the difference being in some cases nearly 100 per cent.

The capacity of a boiler depends on the form and extent of the heating surface, the water and steam space and upon the amount of grate surface.

A boiler horse power is arbitrarily defined as the evaporation of 34½ pounds of water per hour from a temperature of 212 degrees to steam at atmospheric pressure, which, as the evaporation of one pound of water under these conditions requires 965.7 British Thermal Units, is the equivalent of 33,316 British Thermal Units. As one square foot of direct steam radiating surface emits approximately 250 British Thermal Units per hour a boiler horse power should supply 133 square feet of radiating surface.

To allow for less efficient management of heating boilers than of power boilers, however, it may be considered good practice to limit the radiating surface which may be supplied by one boiler horse power to 100 square feet.

The heating surface required per boiler horse power in power boilers usually ranges



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Area Sq. Ft.	Cubic Ft. Capacity	Size Pump	H. P. Motor	No. Spray Heads	G. P. M.	DIMENSIONS	
						Height	Width
10	5,000	1 1/4 in.	1	10	30	3 ft. 0 in.	4 ft. 0 in.
15	7,500	1 1/4 in.	1 1/4	14	42	3 ft. 6 in.	5 ft. 0 in.
20	10,000	1 1/2 in.	1 1/2	18	54	4 ft. 3 in.	5 ft. 0 in.
30	15,000	2 in.	2	26	78	5 ft. 0 in.	6 ft. 0 in.
40	20,000	2 in.	2 1/2	38	114	6 ft. 3 in.	6 ft. 9 in.
50	25,000	2 1/2 in.	3	46	138	7 ft. 0 in.	7 ft. 6 in.
60	30,000	2 1/2 in.	3	56	168	7 ft. 6 in.	8 ft. 0 in.
80	40,000	3 in.	4	76	228	8 ft. 0 in.	10 ft. 0 in.
100	50,000	3 in.	5	92	276	8 ft. 0 in.	12 ft. 6 in.
120	60,000	3 1/2 in.	6	100	320	10 ft. 0 in.	12 ft. 0 in.
140	70,000	3 1/2 in.	7 1/2	116	346	11 ft. 0 in.	13 ft. 0 in.
160	80,000	4 in.	10	126	400	11 ft. 6 in.	14 ft. 0 in.
180	90,000	4 in.	10	112	446	12 ft. 9 in.	14 ft. 6 in.
200	100,000	5 in.	12 1/2	160	500	13 ft. 9 in.	14 ft. 6 in.
220	110,000	5 in.	12 1/2	178	540	14 ft. 9 in.	16 ft. 6 in.

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from $7\frac{1}{2}$ to 12 square feet, dependent upon the kind of boiler. For heating service, it seems safe to assume that the heating surface per boiler horse power, or per 100 square feet of radiation supplied should rarely be less than 15 square feet.

In power boilers the ratio of grate surface to heating surface usually ranges from 1 to 40, to 1 to 60. In boilers for heating service the ratio of grate surface to heating surface should not be less than 1 to 40 and preferably more.

The satisfactory operation of any boiler is dependent upon sufficient draft as well as upon other conditions. Sufficient draft is obtained by proper chimney proportions.

CHIMNEYS.

Kent gives the following:

The commonly accepted theory of chimney draft based on Peclet's and Rankine's hypotheses (see Rankine, S. E.), is discussed by Prof. De Volson Wood in Trans. A. S. M. E., Vol. XI.

Peclet represented the law of draught by the formula

$$h = \frac{u^2}{2g} \left((1 + G + \frac{f}{m}) \right)$$

in which "h" is the "head," defined as such a height of hot gases as, if added to the column of gases in the chimney, would produce the same pressure at the furnace as a column of outside air, of the same area of base, and a height equal to that of the chimney;

"u" is the required velocity of gases in the chimney;

"G" a constant to represent the resistance to the passage of air through the coal;

"l" the length of the flues and chimney;

"m" the mean hydraulic depth or the area of a cross-section divided by the perimeter;

"f" a constant depending upon the nature of the surfaces over which the gases pass, whether smooth, or sooty and rough.

Rankine's formula (Steam Engine, p. 288), derived by giving certain values to the constants (so-called) in Peclet's formula, is

$$h = \left[\frac{\frac{T_0}{T_2} (0.0807)}{\frac{T_0}{T_1} (0.084)} \right] H - H (0.96 \frac{T_1}{T_2} - 1) H$$

in which H = the height of the chimney in feet;

$T_0 = 493^\circ$ F. absolute (temperature of melting ice);

T_1 = absolute temperature of the gases in the chimney.

T_2 = absolute temperature of the external air.

SIZES FOR CHIMNEYS.

A very essential adjunct to the working

of a plant is the chimney flue, and the form of the flue has much to do with its effectiveness; thus as gases ascend in a spiral motion a round flue is the best, and a square one is better than one of rectangular shape. If of brick it should be evenly plastered. The flue should extend below the smoke pipe connection only a short distance to permit the removal of soot; if continued far below it will form an air pocket and cause down currents.

Sq. Feet of Direct			Sq. Feet of Direct
Steam Radiation	Horse Power	Size of Chimney	Water Radiation
250	2.5	8"x 8"x25'	400
500	5.0	8"x12"x30'	850
800	8.0	12"x12"x35'	1350
1400	14.0	12"x16"x40'	2400
2200	22.0	16"x16"x50'	3700
3500	35.0	18"x18"x60'	5900
5500	55.0	20"x20"x70'	9300
8000	80.0	24"x24"x80'	13000

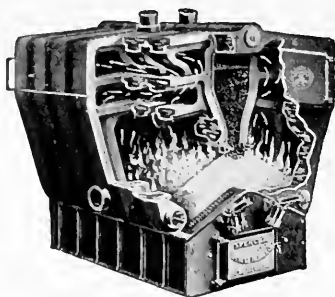
AUTOMATIC HEAT REGULATION.

Automatic heat regulation is now recognized as a very convenient item in the equipment of modern buildings.

Its application naturally depends upon the character of the heating apparatus, it being essential in all cases that each heated apartment be supplied with at least one of the temperature controlling instruments called "thermostats," this "thermostat" regulating automatically the sources of heat supply for the apartment in which it is placed.

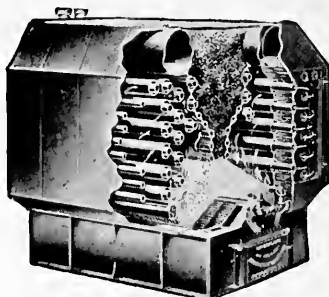
If the system of heating be direct radiation, the control of the radiators is accomplished by means of pneumatic diaphragm valves taking the place of the ordinary hand valves, these pneumatic valves being connected with the "thermostat." If indirect heat is used, the passage of the warm air through the heat flues is usually controlled by "mixing dampers," so arranged as to automatically mix hot and cold air in the proper proportions before it reaches the apartment, these mixing dampers being under the control of the "thermostats."

The heat regulation systems of recognized standing are generally operated by compressed air supplied by a suitable compressor in the basement, and distributed throughout the building by a system of galvanized iron and lead piping. The manufacturers of these systems invariably install the apparatus themselves, either as principal or sub-contractors, but in all cases executing to the owner a guarantee covering the operation and care of the system. The evidence seems to show that a saving of from 15 to 25 per cent in fuel consumption is accomplished in those buildings which are equipped with automatic heat regulation. This is a sufficiently large return upon the cost of the apparatus to justify its use in the majority of buildings. In theaters, assembly halls, schools, etc., its use is imperative for hygienic reasons as well.



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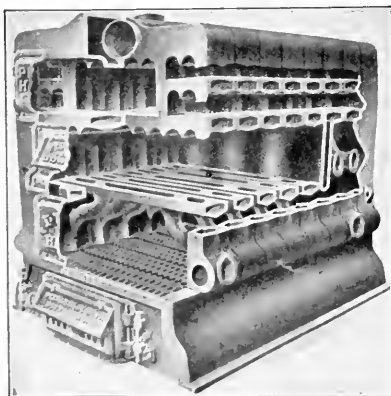
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TABLE OF EQUIVALENT TEMPERATURE FOR TESTING A HEATING PLANT AT DIFFERENT OUTSIDE TEMPERATURES.

For the purpose of indicating the efficiency of the apparatus for any specified condition, Prof. Carpenter gives the following table, which has been generally accepted as the standard test.

For steam, the radiator temperature in all cases is assumed to be that due to a pressure of 3 pounds at the boiler, or about 220° Fahr.

For water, the radiator temperature is assumed in all cases to be at an average of 160° Fahr.

For a plant proportioned sufficiently to maintain a temperature of 70° when the outside temperature is at zero.

Temperature of Outside Air	Room should be raised to
-10	64.7
0	70.0
10	75.1
20	81.0
30	86.5
40	93.1
50	98.7
60	104.7
70	110.5
80	117.1
90	123.5
100	130.3

See University of Illinois Engineering Experiment Station Bulletin No. 31 for methods and results of tests on house heating apparatus. These tests have been made on different kinds of house heating apparatus with different kinds of fuel. The bulletin embodies the results of about three hundred tests. These bulletins are for free distribution.

EXPANSION AND CONTRACTION.

Scarcely anything can withstand the expansion of iron. It expands from 23° to 212°, about 1/900 of its length, which in 100 feet equals 1 1/8 inches. The expanding power of a 2-inch pipe when heated to a temperature of 100 pounds steam, or to 338°, exerts a force sufficient to move 25 tons.

Cast iron expands 1/162000 of its length for each degree Fahr. it is subjected to within ordinary limits while in its solid state.

Wrought iron expands 1/150000 of its length for each degree Fahr. To find the expansion of a line of pipe, multiply its length in inches by the number of degrees of temperature applied and divide the product by 150,000 for required expansion in inches; thus $100' \times 12" = 1200 \times 338 = 405600 \div 150000 = 2.7$ inches.

For example: find the lineal expansion in a wrought iron pipe 100' long, containing steam at 338°. Expansion equals $100' \times 12" \times 338$, divided by 150,000, equals 2.7".

Special attention, then, must be given to the expansion and contraction of pipes and allowance made for it. Pipes and branches must be unconfined, especially in the direction of their length.

Expansion joints should not be used if the expansion can be compensated for in any other way.

RADIATION OF HEAT.

Radiation of heat takes place between bodies at all distances apart, and follows the laws for the radiation of light.

The heat rays proceed in straight lines.

and the intensity of the rays radiated from any one source varies inversely as the square of their distance from the source.

This statement has been erroneously interpreted by some writers, who have assumed from it that a boiler placed two feet above a fire would receive by radiation only one-fourth as much heat as if it were only one foot above. In the case of boiler furnaces the side walls reflect those rays that are received at an angle—following the law of optics, that the angle of incidence is equal to the angle of reflection,—with the result that the intensity of heat two feet above the fire is practically the same as at one foot above, instead of only one-fourth as much.

(Incidentally, where the boiler is sufficiently far removed from the grates to permit of thorough combustion of the gases, the intensity of the heat is greater than where the boiler is set lower.)

The rate at which a hotter body radiates heat, and a colder body absorbs heat, depends upon the state of the surfaces of the bodies as well as on their temperatures. The rate of radiation and of absorption are increased by darkness and roughness of the surfaces of the bodies, and diminished by smoothness and polish. For this reason the covering of steam pipes and boilers should be smooth and of a light color; uncovered pipes and steam-cylinder covers should be polished.

The quantity of heat radiated by a body is also a measure of its heat-absorbing power, under the same circumstances. When a polished body is struck by a ray of heat, it absorbs part of the heat and reflects the rest. The reflecting power of a body is therefore the complement of its absorbing power, which latter is the same as its radiating power.

The relative radiating and reflecting power of different bodies has been determined by experiment, but as far as quantities of heat are concerned, says Prof. Trowbridge (Johnson's Cyclopaedia, art. Heat), it is doubtful whether anything further than the said relative determinations can, in the present state of our knowledge, be depended upon, the actual or absolute quantities for different temperatures being still uncertain. The authorities do not even agree on the relative radiating powers.

HEATING BY ELECTRICITY.

Heating by electricity is entirely feasible and practical where the cost of electric current is very low. At the ordinary prevailing rates, however, the cost is prohibitive. The reason for this is that where electricity is generated in a steam plant using simple engines, only about 4% of the B. T. U. in the steam is delivered to the switchboard in the form of electrical energy. In stations where the highest type of generating apparatus is used, this percentage may be increased to 20%.

While the large power boiler is more economical in the production of steam than the small heating boiler, the fact that only 4% to 20% of the steam generated by the large power boiler is available as electrical energy makes the cost of this form of heating prohibitive.

STEAM BOILER AND PIPE COVERINGS.

Experiments under actual steam plant conditions, conducted by Geo. M. Brill (Trans. Am. Soc. Eng. Vol. XVI) show that in ordinary practice the early results and theories, advanced by Sir Isaac Newton and Pecklet, are too low. He found that by using an

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8 inch bare steam pipe 60 feet long with an average pressure of 110.5 lbs. by gauge, and with air 75.5 degrees Fahrenheit, that 736,546 B. T. U. per square foot of surface per hour, were lost. These results accord so closely with the experiments conducted by Prof. R. C. Carpenter of Cornell University, and Prof. M. E. Cooley of the University of Michigan, that it seems fair to use these results as a premise of calculation in practical work. The magnitude of the loss from a bare pipe can be understood possibly more closely by the following calculation:

Adopt from Mr. Brill's results a loss of 736,546 B. T. U. per square foot of surface per hour and, assuming an 8-inch pipe to be 100 feet long, the loss would then be as follows:

736,546 B. T. U. multiplied by 225 square feet (surface of an 8-inch pipe 100 feet long) equals 165,722 B. T. U. lost per hour or, divided by 30,000 B. T. U., heat units in one horse-power at above pressure (assuming 34½ lbs. of water from and at 212 degrees to be a horse-power) equals 5.5 horse-power per hour lost. The method adopted for preventing in a measure this loss is by the application of some non-conducting material to the radiant body, having for its object the protection of the external surfaces from loss of heat and from any injurious action liable to occur in consequence of their exposure. It will therefore be seen that a great economy is effected by the application of pipe covering or boiler lagging.

VENTILATION.

The term ventilation, when used in the ordinary sense is a purely relative term. Every room or building, unless it is hermetically sealed is "ventilated" to a certain extent. A room heated with steam or hot water direct radiation and with all the windows and doors closed is ventilated by the amount of air leakage, due to the fact that neither the doors nor windows nor even the walls are air tight and there is a constant tendency for the interchange of air from the outside to the inside of the building. With the indirect system of heating, fresh air from the outside is introduced at a definite point and by means of a system entirely under control at all times.

The ducts supplying the air to the indirect radiation are usually provided with dampers, so that the amount of fresh air can be absolutely regulated. From the standpoint of ventilation, indirect radiation is far superior to direct radiation, but on account of the very much greater cost of operation, the amount of indirect radiation is usually restricted to one or two stacks in the ordinary residence.

In laying out any system of ventilation it is necessary to decide first of all on the standard of purity to be maintained. Pure country air contains about four parts of CO₂ in 10,000. This amount of CO₂ can be increased to 6, 8 and even 10 parts without any bad results to the occupants of the room. Naturally there is no sharp, well defined line above which ventilation is totally bad or below which the ventilation may be referred to as absolutely good. As a general proposition, it may be said, however, that a system of ventilation which permits the CO₂ to rise above 12 parts in 10,000 is not a good modern ventilating system, while

on the other hand, for commercial reasons, it is seldom that an attempt to keep the air purer than 6 parts of CO₂ in 10,000 is made.

This assumes that CO₂ is not the only impurity in the air, but rather is an indicator of the presence of other impurities as well. In other words, an artificial mixture of twelve parts of CO₂ in 10,000 would not contain the same amount of impurities and would, therefore, not represent the same degree of ventilation as the air in an assembly hall containing twelve parts of CO₂ in 10,000.

In calculating the probable impurities, it may be assumed that the ordinary person in average good health, exhales 0.6 of a cubic foot of CO₂ per hour and a "5-foot" gas burner vitiatates about five times as much air as the ordinary person. A gas grate or any open fire-place, on the other hand, has a tendency to improve the ventilation; for while it uses up oxygen, it must be kept in mind that all the gases which pass up the chimney, must in the natural course of events be replaced by fresh air through the doors and windows.

As incandescent electric lights use up no oxygen, they have no effect on the ventilation of a room. In hospitals the amount of fresh air required for occupants is naturally much greater than in buildings occupied by persons in good health. The amount of fresh air per occupant must be doubled and some times trebled to maintain the required standard of purity.

The Chicago Commission on Ventilation in their report for 1914, says:

"However satisfactory the quantity of air furnished for the ventilation of a room, and however satisfactory may be the means employed for properly distributing it, both of which in the long run are very important, nevertheless the human body makes an immediate demand which may overshadow either or both. IMMEDIATE PHYSICAL COMFORT IS THE STANDARD OF THE HUMAN BODY, whatever the consequences, as exemplified either in the drowsy stupor that descends on one immersed in a hot, stifling atmosphere on a cold wintry night, or in the quiet repose that comes from a balmy summer breeze outdoors. Good ventilation shall produce immediate comfort."

One of the most prominent as well as immediate factors in the production of comfort, is temperature. * * *

The comfort of the human body is largely influenced by the temperature of the surrounding air, and also, and at the same time, by the rate at which perspiration may evaporate into the air from the body. Relative humidity influences the rate at which such evaporation occurs, but it is only in recent years that much consideration has been given to atmospheric humidity in relation to temperature and comfort."

TEMPERATURE AND HUMIDITY IN RELATION TO COMFORT.

"It has become traditional in this country that the best temperature to maintain in a room is 68 to 70 degrees. There are, however, some who urge that these temperatures are too high, and they cite the English practice of 59 to 62 degrees as evidence of their claim. The difficulty with both these positions is that in deciding on the best temperature, proper consideration is not given to relative humidity. Any adult knows that sultry days are much less comfortable than days of even higher temperature when the atmosphere is comparatively dry. This well known fact of outdoor experience must be taken into account, especially since it is now recognized

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that in cold weather we need to humidify air indoors. On this point of humidity, it may be said that the human organism seems to be adapted to a large range of relative humidity, but it is not accustomed to abrupt changes such as one might experience on a cold day in passing from the outdoors into a heated room. In a word, it seems important from the standpoint of health and comfort to maintain a fair degree of correspondence between the relative humidity of outdoors and indoors."

"Any system of ventilation to be practicable, must produce a feeling of comfort, and therefore both the temperature and the relative humidity of the air are important in ventilation. Temperature and relative humidity jointly help determine comfort."

"It has generally been considered that a temperature of from 68 to 70 degrees with a relative humidity of 70 percent, is a most desirable condition to obtain (the 70 percent relative humidity also is largely traditional). In our tests it was assumed that the best temperature may or may not be 68 to 70 degrees; and also the most satisfactory relative humidity may or may not be 70 percent."

Ventilating systems may be divided into gravity and mechanical systems. Air can be moved into and from a room only by some form of power expenditure. When air is warmed, approximately one-third of the heat imparted to it is expended in work of expanding the air and is, in part at least, available for ventilating purposes.

In a gravity ventilating system, the working pressure is due to the difference in weight between the air inside and the air outside of the building or duct. This working pressure is much smaller than the pressures ordinarily used in a fan or mechanical ventilation system.

If the working pressure in a gravity ventilation system is small, the supply and discharge ducts must be made proportionately larger. The cross sectional area of these ducts is governed by the temperature of the air in the supply ducts and the highest outside temperature for which the vent ducts are provided. The cross sectional areas also are modified by the straightness and smoothness of ducts, the height of ducts and numerous other local conditions.

With indirect systems of heating, fresh air from the outside is introduced at definite points where indirect radiation is installed. The ducts supplying the air to the indirect radiation must be provided with dampers so that the amount of fresh air can be regulated. If they were not provided with dampers, the amount of air supplied in cold weather would be excessive and the cost of heating, therefore, would be too great.

The so-called mechanical ventilation systems are superior to gravity ventilation systems in that they require relatively small space for ducts and in the uniformity of ventilation secured, as they are independent of temperature or weather conditions.

The fan system of heating and ventilating is desirable from the ventilating standpoint to just the extent that fresh air is drawn from the outside. It should be understood that it is possible to operate a fan system, drawing the entire supply from the inside of the building. In this case, even though there is a movement of air, the ventilation is no better than with the ordinary direct radiation system.

Systems have been installed in which all

the air is recirculated but passed through an air washer before being again delivered to the rooms. The theory is, that washing the air removes its objectionable qualities. There is a decided difference of opinion as to the merits of this system. At this time there is insufficient data at hand to either prove or disprove the claims made.

If all the air is taken from the outside, the combined heating and ventilating system will provide the very best of ventilation. In practice, for purposes of economy, fan systems are usually designed to take most of the air from the outside, but a by-pass is provided so that in extreme cold weather, part of the air can be drawn from the inside of the building.

Quite frequently a combination of a direct heating system and a fan ventilation system is used. In such cases the heating system is usually designed to provide sufficient temperature under all weather conditions. The fan ventilating system is designed to supply sufficient air to maintain a pre-determined standard of purity and is then provided with just sufficient radiation to heat this air to the room temperature. In other words, the direct radiation is depended upon for heat and the fan system is depended upon to furnish the ventilation only.

In laying out a fan system of ventilation, great care must be taken to avoid drafts. Where air is introduced at or near the ceiling, a register velocity of 600 feet per minute is permissible, but where air is introduced at or near the floor line, the velocity must not exceed 200 feet per minute as a maximum, and in many cases where the best results are desired, the velocity is kept down to about 125 feet per minute. The velocity through the register of a vent flue may be very much greater than through a fresh air register. Except where the register is so located as to directly expose the occupants of the room to a draft, it is not unusual to permit a register velocity of 600 feet per minute.

In no case are register velocities over 600 feet per minute desirable because even though the register may be so located that there may be no trouble from draft, there will be a distinct "humming" noise which is disagreeable.

AIR WASHERS:

The use of air washers in connection with fan ventilating systems, is almost always desirable and in most cases absolutely necessary, in order to assure a supply of clean, pure air.

All air washers consist primarily of a spray chamber in which the air is made to pass through a fine spray of water, and an eliminator or separator in which the water is separated from the air.

The movement of air, containing particles of dust and dirt, through a system of ducts is bound to cause a deposit of part of the impurities on the walls of the ducts. As it is next to impossible to clean the average ventilating duct, this, in time, becomes so dirty that no matter how clean the air leaving the fan, some dirt will be carried into the room through the fresh air registers. From this, it is evident that even though air washers do not remove all of the dust in the air, the use of an air washer improves a ventilating system by just the amount of dirt that the washer removes.

It should also be noted that air washers present a convenient means of increasing the humidity of the air.

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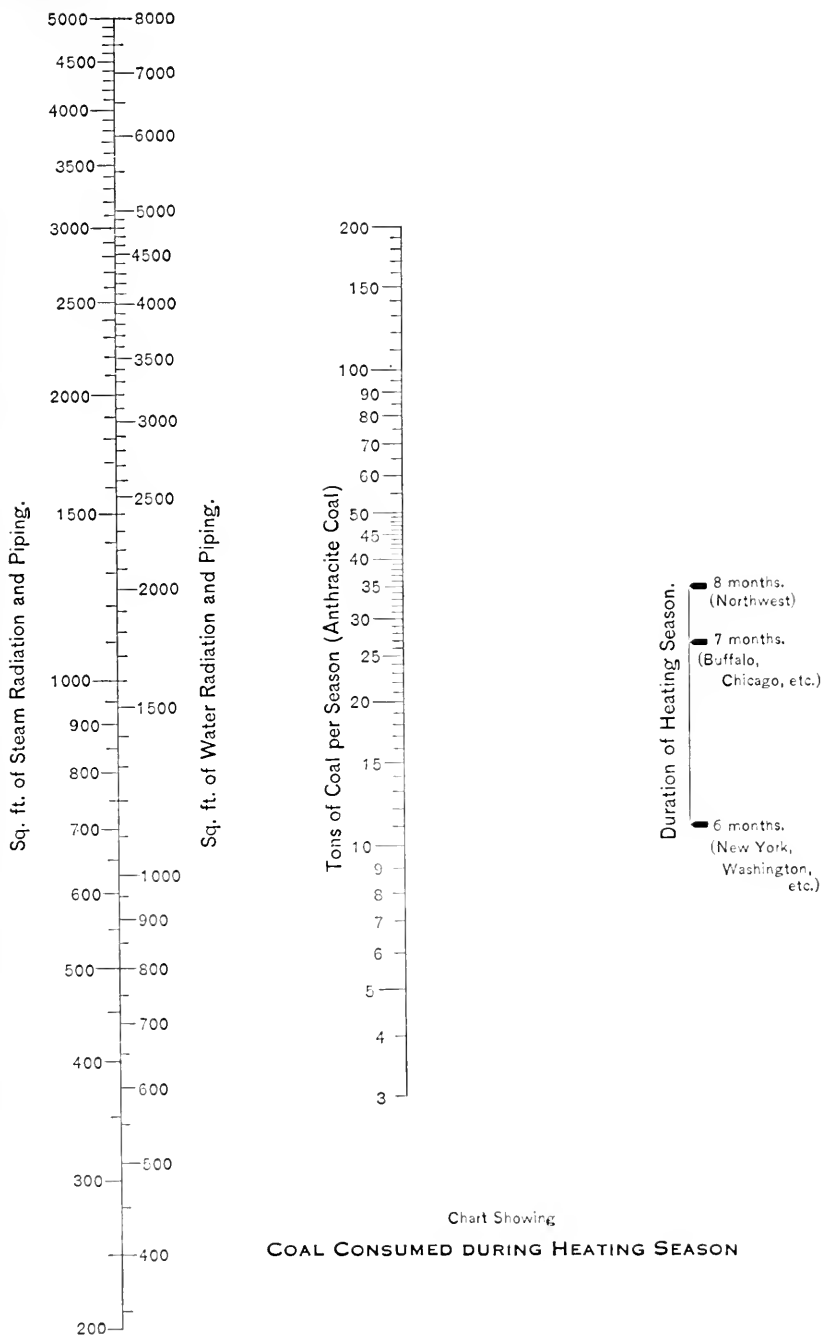
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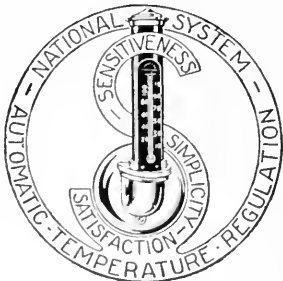
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SECTIONS OF THE SANITARY CODE OF INTEREST TO ARCHITECTS, WITH INDEX

INDEX

Amendments to Sanitary Code passed since March 13, 1911, amending Section 2854	Sec.
Architects' penalty	4
Architects' plans	1
Distances between buildings on same lot	1377
Dry cleaners—Building requirements—Ventilation—Equipment—Lighting—Water trough	2854
Frontage consents required, when.....	1219
Handling of oils.....	2855
Height of ceilings—Windows.....	1379
Hospitals defined	1213
Lodginghouse defined	1388

Location of hospitals near schools....	1220
Lodginghouses, penalty	1389
Lodginghouse—Ventilation	1378
Seats for females.....	1402
Seats for females—Penalty.....	1403
Tenement and lodging houses conform to requirements	1376
Undertakers; care of dead human bodies; burials	1238
Undertaking rooms	1239
Ventilation of stores, factories, workshops, etc.	1399
Workshops—Workshops defined	1399
Water supply—Cellar floor—Ventilation of halls	1380

Architect—plans.] Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: That it shall be the duty of any architect or architects, builder or builders of, or other person or persons interested in any projected tenement, lodging house, or other places of habitation, in any incorporated city of fifty thousand inhabitants, to submit plans and specifications of any such building or buildings to the health commissioner or commissioners of such incorporated city; that the said health commissioner or commissioners may examine the said plans and specifications, for his or their approval or rejection, as to the proposed plans for the ventilation of rooms, light and air shafts, windows, ventilation of water closets, drainage and plumbing.

Architect—penalty.] Section 4. If any architect or architects, builder or builders, violate the provisions of this act, he or they shall be fined in a sum not less than one hundred nor more than two hundred dollars for each offense.

HOSPITALS.

1213. Hospital defined.] For the purpose of this article a hospital is hereby defined to mean any institution or place used for the reception or care, temporary or continuous, of two or more sick, injured or dependent persons; or used for the treatment of two or more persons suffering from or afflicted with any mental or physical disease or bodily injury, including all hydro-pathic and massage institutions.

For the purposes of this article a maternity hospital is hereby defined to mean any institution or place used for the reception and care, temporary or continuous, of one or more women during pregnancy while awaiting confinement, during confinement, or for one month or less after confinement while recovering therefrom.

Unless otherwise specified, the word "hospital" as used in this article shall be held to include maternity hospital.

1219. Frontage consents required—when.] It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage in any block, in which two-thirds of the buildings fronting on both

sides of the street or streets on which the proposed hospital may front are devoted exclusively to residence purposes, any hospital, unless the owners of a majority of the frontage in such block, and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building faces, consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in such block. Such written consents of the majority of said property owners shall be filed with the commissioner of health before a permit shall be granted for the building or constructing or a license be issued for the maintaining, conducting or managing of any such hospital.

1220. Location of hospitals near school.]

No hospital of any kind or description shall hereafter be erected or established within four hundred feet of any property used for public or parochial school purposes.

UNDERTAKERS; CARE OF DEAD HUMAN BODIES; BURIALS.

1238. Frontage consents.] It shall be unlawful for any person to carry on the business of an undertaker, as defined in this article, who, in connection with such business, receives at his place of business the body of any dead person, for embalming or other purposes, where such place of business is located on any street in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, without the written consent of a majority of the property owners according to the frontage on both sides of such street in such block; provided, however, that nothing herein contained shall apply to persons licensed as undertakers at the time of the passage of this ordinance.

Such frontage consents shall be obtained and filed with the department of health before a license shall issue for such business.

1239. Undertaking rooms.] No person shall be licensed to carry on the business of undertaking in any establishment, store or place, unless such establishment, store or place shall be provided with a compartment or room completely shut off or capable of being completely shut off from the other

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parts of such establishment, store or place; such compartment or room shall have free outside ventilation and light, and its floor shall be constructed of or covered with a non-absorbent material and shall be connected with a sewer by an approved sanitary drain.

TENEMENTS AND LODGING HOUSES.

1376. Conform to requirements.] No house or building hereafter erected shall be used as a tenement house or lodging house, and no house or building heretofore erected and not now used for such purposes shall be converted into, used or leased for a tenement or lodging house, unless in addition to the requirements hereinbefore contained in article IX of chapter XVI of this ordinance, it conforms to requirements affecting tenement or lodging houses, or both, as specified in the following sections of this article.

1377. Distances between buildings on same lot.] It shall not be lawful hereafter to erect for or convert to the purpose of a lodging house a building on any lot, other than a corner lot, where there is another building on the same lot, unless there is a clear, open space exclusively belonging thereto, and extending upwards from the ground, of at least ten feet between such buildings, if they are one story high above the level of the ground; if they are two stories high, the distance between them shall not be less than fifteen feet; if they are three stories high, the distance between them shall not be less than twenty feet; and if they are more than three stories high, the distance between them shall be not less than twenty-five feet.

1378. Lodging house—ventilation.] Every house, building or portion thereof in the city, designed to be used, occupied, leased or rented, or which is used, occupied, leased or rented, for a lodging house, shall have in every room which is occupied as a sleeping room and which does not communicate directly with the external air, a ventilating or transom window having an opening or area of three square feet over the door leading into and connected with the adjoining room, if such adjoining room communicates with the external air, and also a ventilating or transom window of the same opening or area communicating with the entry or hall of the house; or where this is from the relative situation of the rooms impracticable, such last mentioned ventilating or transom window shall communicate with an adjoining room that itself communicates with the entry or hall. Every such house or building shall have in the roof at the top of the hall an adequate and proper ventilator. No room in any lodging house shall be so occupied that the allowance of air to each person living or sleeping in such room shall at any time be less than four hundred cubic feet for each such person more than twelve years old and two hundred cubic feet for each such person of the age of twelve years or under.

1379. Height of ceilings—windows.] In every such house hereafter erected or converted, every habitable room except rooms in the attic shall be in every part not less than eight feet in height from the floor to the ceiling; and every habitable room in the attic of any such building shall be at least eight feet in height from the floor to the ceiling throughout not less than one-half

the area of such room. Every room shall have at least one window connecting with the external air, or over the door an adequate ventilator connecting it with a room or hall which has a connection with the external air, and so arranged as to produce a cross current of air. The total area of window or windows in every room communicating with the external air shall be at least one-tenth of the superficial area of every such room; and the top of one at least of such windows shall not be less than seven feet and six inches above the floor, and the upper half at least shall be made so as to open the full width. Every habitable room of a less area than one hundred superficial feet, if it does not communicate directly with the external air, and is without an open fireplace, shall be provided with a special means of ventilation by a separate air shaft extending to the roof, or otherwise, as the commissioner of health may prescribe.

1380. Water supply—cellar floor—ventilation of halls.] Every such house hereafter erected or converted shall have proper conveniences and receptacles for ashes and rubbish; it shall have water furnished at one or more places in such house or in the yard thereof, so that the same may be adequate and reasonably convenient for the use of the occupants thereof; it shall have the floor of the cellar properly cemented so as to be water-tight; the halls of each floor shall open directly to the external air, with suitable windows, and shall have no room or other obstruction at the end, unless sufficient light or ventilation is otherwise provided for said hall in a manner approved by the commissioner of buildings.

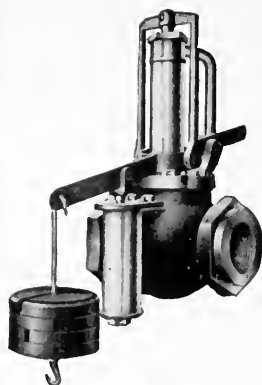
1388. Lodging house defined.] A lodging house shall be taken to mean and include any house or building or portion thereof in which persons are harbored or received or lodged for hire for a single night or for less than a week at one time, or any part of which is let for any person to sleep in for any term less than a week.

1389. Penalty.] Any person who shall violate, disobey, neglect or refuse to comply with, or resist, any of the provisions of this article, or who refuses to comply with any of the sanitary regulations of the department of health concerning any of the matters or things mentioned in this article shall be fined not less than ten dollars nor more than two hundred dollars for each offense.

WORKSHOPS.

1390. Workshop defined.] Any place where goods or products are manufactured or repaired, cleaned or assorted, in whole or in part, for sale or for wages, shall be taken and be held to be a workshop; and whenever any house, room or place is used for the purpose of carrying on any process of making, altering, repairing or finishing, for sale or for wages, any coats, vests, trousers, knee pants, overalls, cloaks, shirts, ladies' waists, purses, feathers, artificial flowers, or cigars, or any wearing apparel of any kind whatsoever intended for sale, it shall be deemed a workshop for the purposes of this article.

No one of the articles mentioned in this section shall be made, finished, altered or repaired in any room or apartment used as a living room or a sleeping room; nor shall any workshop be conducted, maintained, op-



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erated or carried on in any cellar or basement.

STORES, FACTORIES, WORKSHOPS—MISCELLANEOUS PROVISIONS.

1399. Ventilation of stores, factories, workshops, etc.] No person, being the owner, proprietor, lessee, manager or superintendent of any store, factory, workshop or other structure or place of employment where workmen and workwomen are employed for wages, shall cause, permit or allow the same or any portion or apartment of, or any room in such store, factory, workshop or other structure or place of employment, to be overcrowded or inadequate, faulty or insufficient in respect of light, ventilation, heat and cleanliness; and in every such building or apartment, or room in any such building, where one or more persons are employed as aforesaid, at least five hundred cubic feet of air space shall be allowed to each and every person employed therein, and fresh air supplied by ventilation at the rate of four complete changes of air per hour during the hours of employment. No part of such air supply shall be taken from any cellar or basement.

1402. Seats for female:.] It shall be the duty of all employers of females in any mercantile or manufacturing business or occupation to provide and maintain seats for the use of such female employees, and to permit, to a reasonable extent, the use of such seats by such employees during the hours of their employment, for the preservation of their health. Seats shall be furnished at the ratio of one seat for every four female employees. All mercantile and manufacturing occupations and establishments where females are employed shall be inspected by officers of the health department to ascertain if this section is complied with, and any employer violating any of the provisions of this section shall be subject to a fine of not less than five dollars nor more than one hundred dollars.

1403. Penalty.] Any person violating, disobeying, neglecting or refusing to comply with any of the provisions of this article, where no other penalty has been provided, shall be fined not less than ten nor more than one hundred dollars for each offense.

DRY CLEANERS.

2854. Building requirements--ventilation—equipment—lighting—water trough.] Every building used or intended to be used for the purpose of conducting or carrying on the business of dry cleaning, as defined in this chapter, shall be constructed and equipped according to the following specifications:

Every such building shall be built of brick, stone or concrete, with no basement, and shall not exceed two stories in height; provided, however, that the use of any building not exceeding three stories in height in which a dry cleaning business was carried on prior to the passage of this ordinance may be continued, if such building complies in all other respects with the provisions of this chapter. The first floor of such building shall be higher than the surface of the ground surrounding such building and shall be so laid that there shall be no space un-

derneath the same. The floor or floors and roof shall be of fireproof construction, and such floor or floors shall be covered with a wire carpet. There shall be no openings through the floors, excepting in two-story buildings in which a stairway leading from the second floor to the first floor may be permitted, if properly enclosed with walls of incombustible material. Such stairways shall lead to the outside of the building without any doors or openings leading into the dry cleaning room. Every such building shall be detached from all other buildings, or separated from all other buildings by a fire wall, with no openings to the adjoining building thereto, and shall not be occupied for any purpose other than the conduct of a dry-cleaning and dry-room plant. The walls of such building shall be not less than twelve inches thick and shall have vent holes at the floor line, not less than sixteen square inches in area, not less than six feet apart, measured from center to center, which vent holes shall be protected by screens of thirty mesh brass wire on the inside of such walls, and by iron bars or by screens of large mesh on the outside of such walls.

Such building shall be further ventilated by means of an exhaust fan or fans of sufficient capacity to change the air in the building every three minutes, and shall be kept in operation at all times during the use of such building. Such exhaust fan shall be located in an air conduit whose inlet openings shall be at or near the floor level in the wall farthest away from any other building or structure, and the discharge end of such conduit shall be carried over the roof of such building.

All doors in any such building shall be constructed of incombustible materials and shall open outward. All window openings of such building shall be protected by fire resisting glass with metal sash and frames, or by outside iron shutters.


Every such building, two stories high, shall be provided with two stairways leading from the second to the first floor, at least one of which must be placed on the outside and be constructed of iron or steel.

Every such dry-cleaning plant shall be equipped with a high pressure steam boiler of sufficient capacity to admit of flooding the dry cleaning and drying rooms with steam in case of fire. Each room of such building shall be equipped with a line of one and one-fourth inch pipe connected with a one and one-fourth inch supply line leading from such high-pressure boiler and having down-sprouts of at least two inches in length and not less than ten feet apart, distributed over washers and extractors. The valves operating such lines of pipe shall in every case be placed outside of such building; provided, however, that every such dry cleaning plant, constructed and maintained prior to the passage of this ordinance, may, in place of such high-pressure boiler, be equipped with a suitable and adequate tank or tanks containing carbon dioxide. At least one such tank, containing not less than one hundred eighty cubic feet of gas under pressure, shall be provided for each one thousand cubic feet, or fraction thereof, of cubic contents of the room to be protected from fire. The valve or valves operating such tank or tanks shall be located on the outside of such building.

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Whenever steam power shall be used for the operation of any machinery contained in any such dry cleaning establishment, the boiler generating such power shall be located in a separate building and so situated that the line of travel for gases, between the boiler and the nearest opening into the cleaning or drying room, shall be not less than twenty feet, and whenever electrical power is used, the electric motor furnishing such power shall be similarly located; provided, however, that such boiler and electric motor may be located in the same building where such building was used for dry cleaning purposes prior to the passage of this ordinance, if such boiler or electric motor are separated from the dry cleaning or drying room by fire walls having no openings into such dry cleaning or drying room, except such openings as may be required for shafts in operating the machinery contained therein.

Every such building shall be lighted by incandescent electric lamps having keyless sockets, protected by vapor-tight outer globes, and controlled by outside switches. No open light or light or flame of any kind whatsoever shall be allowed or used therein.

Every such establishment shall be provided with a tank not less than four feet long, two feet wide and three feet deep, which shall be placed near the entrance to the dry cleaning room and shall be kept filled with water.

2855. Handling of oils.] Tanks for the storage of any one or more of the oils or fluids mentioned in section 2851 of this chapter must be placed outside of the buildings used for such dry cleaning establishment and must comply with the ordinances of the city of Chicago relating to the storage of oils. No such tank shall be built underneath any such building. Pumps or devices for the removal of the contents of such tanks, which are operated by hand power, and which have been approved by the fire marshal of the city of Chicago, may be placed inside of any such building. All gasoline used in any such building shall be conveyed to and from the same through closed metal piping; no open troughs shall be permitted. There shall be no piping or connection whereby any of the oils or fluids mentioned in this chapter may flow from the cleaning room into any public or private sewer, drain, catch basin or pit.

**AMENDMENTS TO THE SANITARY CODE
PASSED SINCE MARCH 13, 1911.**

**An Ordinance, Passed November 20, 1911,
Amending Section 2854 of The Chicago
Code of 1911.**

Be it ordained by the City Council of the City of Chicago:

Section 1. That the first three paragraphs of Section 2854 of The Chicago Code of 1911, being all that part of said Section 2854 before the paragraph beginning, "All doors in any such building," be and the same are hereby amended so as to read as follows:

"2854. Building Requirements—Ventilation—Equipment—Lighting—Water Trough.] Every building used or intended to be used for the purpose of conducting or carrying on the business of dry cleaning as defined in this chapter, shall be constructed and equipped according to the following specifications:

Every such building shall be built of brick, stone or concrete, with no basement, and shall not exceed two stories in height; provided, however, that the use of any building not exceeding three stories in height, in which a dry cleaning business was carried on prior to the passage of this ordinance may be continued, if such building complies in all other respects with the provisions of this chapter. The first floor of such building shall be higher than the surface of the ground surrounding such building, and shall be so laid that there shall be no space underneath the same. The floor or floors and roof shall be of fireproof construction. There shall be no openings through the floors, excepting in two-story buildings, in which a stairway leading from the second floor to the first floor may be permitted, if properly enclosed with walls of incombustible material. Such stairways shall lead to the outside of the building without any doors or openings leading into the dry cleaning room. Every such building shall be detached from all other buildings; provided, however, that the use of any building in which a dry cleaning business was carried on prior to the passage of this ordinance may be continued where such building is separated from all other buildings by a fire wall, with no openings into any adjoining building. Such building shall not be occupied for any purpose other than the conduct of a dry cleaning and dry room plant. The walls of such building shall be not less than twelve (12) inches thick and shall have vent holes at the floor line not less than sixteen (16) square inches in area when ventilation by means of exhaust fan or fans is employed, and not less than thirty-two (32) square inches in area when ventilation by means of paddle-wheel type fan or fans is employed; such vent holes shall be not less than six (6) feet apart, measured from center to center, and shall be protected by screens of thirty (30) mesh brass wire on the inside of such walls, and by iron bars or screens of large mesh on the outside of such walls.

Such building, unless divided into compartments, as hereinafter described, shall be further ventilated by means of an exhaust fan or fans of sufficient capacity to change the air in the building every three minutes, and shall be kept in operation at all times during the use of such building. Such exhaust fan shall be located in an air conduit whose inlet openings shall be at or near the floor level in the wall farthest away from any other building or structure, and the discharge end of such conduit shall be carried above the roof of such building. If such building be divided into fireproof compartments, by partitions of six-inch hollow tile, or equivalent, extending from floor to ceiling, each such compartment having a capacity of not to exceed twenty-five hundred (2500) cubic feet, the exhaust fan or fans and air conduit before mentioned may be omitted from each of such compartments, and in lieu thereof there shall be a paddle-wheel type fan attached to the line shafting in each compartment, of sufficient size to displace an amount of air equal to the cubical contents of the compartment at least once each minute."

Section 2. This ordinance shall take effect and be in force from and after its passage and due publication.



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PLUMBERS AND PLUMBING

ARTICLE I.

Plumbers.

1775. Certificate of competency required.]

Any person now engaged in, or hereafter engaging in, or working at, the business of plumbing in the city, either as master plumber or employing plumber, or as a journeyman plumber, shall obtain a certificate as to his competency to engage in such business in such manner as is hereinafter provided.

1782. Plumbers' bond.]

No person, except a licensed plumber, shall be permitted to make any alteration or repair to or do any work in or about any pipe or pipes connected with any part of the city water works system, or with any pipe or sewer connected with the city sewer system; provided, however, that such licensed plumber shall execute to the city a good and sufficient bond in the penal sum of ten thousand dollars with sureties to be approved by the commissioner of public works, conditioned for the faithful observance and performance of all the ordinances of the city then in force or which may thereafter be in force concerning or regulating the water works system or the sewer system of the city, or concerning the making or maintaining of any connection or connections thereto or therewith; and conditioned further, to indemnify, save and keep harmless the city from any loss, cost, damage, expense or liability of any kind whatsoever which the said city may suffer or which may accrue against it, be charged to or recovered from said city from or by reason of any thing done by such licensed plumber or by any servant, agent or employee of his in and about the making of any alterations or repairs to or any work done in connection with any service pipe or pipes, water main or connection with the water works system of the city, or any drain or pipe or connection with the sewer system of the city, or which may arise from or by reason of any negligence on the part of such licensed plumber in not maintaining barriers and warning signals around any excavation or opening which has been made by him in any street, alley or public way, in pursuance of the work of repairing, altering or locating any service pipe or pipes or connection to or with the water works system of the city, or sewer system of the city; and conditioned further to restore the surface of any street, sidewalk or roadway wherever the same shall have been disturbed by him in and about the doing of any work; and conditioned further to do such work of restoration to the entire satisfaction and approval of the commissioner of public works.

No permit shall be issued to any plumber to do any work necessitating the disturbance of any street, alley or public way, or alteration, repairing or location of any service pipe or pipes connected with the water works system of the city, or any drain or pipe connected with the sewer system of the city, unless such bond be in full force and effect and on file in the office of the commissioner of public works.

ARTICLE II.

Plumbing.

1783. Permit for use of water.]

All applications for permits for the introduction or

use of water supplied by the city shall be made in writing upon printed forms furnished by the department of public works, the blanks to be specifically and properly filled in and signed by the owner or duly authorized agent of the owner, and no work whatever shall be done in the street, or outside a building, by any plumber or other person for the purpose of making any connection to or with any city water main or pipe until after the issuance of such permit. This restriction shall not prevent any person from rendering assistance in case of accident to water pipes occurring at night, or at any time requiring immediate action. In case of any such accident prompt report thereof shall be made to the department of public works by the person rendering such assistance.

1784. Tapping street main.] No person except the tappers employed by the department of public works shall be permitted under any circumstances to tap any street main or insert stop-cocks or ferrules therein. All service cocks or ferrules must be inserted at or near the top of the street main, and not in any case nearer than six inches from the bell of the pipe. The size of the cock to be inserted shall be that specified in the permit.

1785. Lead pipe—kind permitted—weight required.] No lead pipe shall be used in any work done under the authority of a license or permit issued by the city, except such as is known to the trade as "strong," and every lead pipe so used must weigh as follows:

Half-inch internal diameter	.....1 1/4	pounds per lined foot.
Five-eighths in. internal diameter	.....1 1/2	" " " "
Three-fourths in. internal diameter	.....3	" " " "
One inch internal diameter	.....4	" " " "
One and one-fourth in. internal diam.	.....1 1/4	" " " "
One and one-half in. internal diameter	.....6	" " " "
One and three-fourths in. inter. diameter	.....6 1/2	" " " "
Two in. inter. diam.	.....8	" " " "

No pipe shall be used for the purpose of street service of a different material or size from that herein specified, except by special permit, issued by the commissioner of public works.

1786. Service pipe—joints.] All service pipes leading from street mains to the building line shall as far as practicable be laid in the ground to a depth of not less than five feet, and every such pipe shall be laid in such manner and be of such surplus length as to prevent breakage or rupture by settlement, and all joints in such pipes shall be of the kind termed "plumber or wiped joints." The connections of pipe by the so-called "cup-joint" is prohibited.

1787. Stop-cocks.] Every service pipe shall be provided with a stop-cock for each consumer, easily accessible, placed beyond damage by frost and so situated that the water can be conveniently shut off and drained from the pipes.

1788. Stop-cock—location—shutoff box.] Such stop-cocks, unless otherwise specially permitted, shall be connected to service pipes within the sidewalk at or near the curb line

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of the same, and be inclosed in and protected by a cast-iron box with a cover having the letter "W" of suitable size cast thereon; such iron box shall be of form and dimensions satisfactory to the commissioner of public works and shall extend from service pipe to surface of sidewalk, and be of proper size to admit a stop key for operating the stop-cock.

1789. Single tap for several buildings— independent cocks required.] Whenever two or more distinct buildings or premises are to be supplied by means of branch or sub-service pipes supplied by a single tap in the street main, each branch shall be independently arranged with stop-cock and box on the curb line in the manner above described. All cocks used at the sidewalks by plumbers shall be of the kind known as "round water way."

1790. Opening of streets—permit—deposit.] Before filling any trench the service cock in the street main shall be covered with a suitable cast-iron box furnished by the city; the earth shall be well rammed under the main to a level with the top thereof; from thence the trench shall be filled in layers of not more than twelve inches in depth, and each layer thoroughly rammed or puddled to prevent settlement. This work, together with the replacing of sidewalks, ballast and paving shall be done in all cases by the city. A sufficient sum of money shall be deposited with the city before the issuance of the permit for opening the street, to cover this expense.

No permit shall be granted for the opening of any paved street for the tapping of mains or laying of service pipes, when the ground is frozen to a depth of twelve inches or more, except when in the opinion of the commissioner of public works there is a sufficient emergency to justify it.

All of the provisions and restrictions relating to the opening of streets, alleys and public ways and doing of underground work therein as set forth in sections 2148 and 2150 shall be complied with by every plumber performing any such work.

1791. High pressure steam boiler—supply tank required.] All persons are prohibited from connecting pipes whereby high pressure steam boilers may be supplied with water direct from city water mains. All such boilers shall be provided with a tank or other receptacle of sufficient capacity to hold at least six hours' supply of water, which may be used in case of a pipe district being shut off for the repair of water mains or for the making of connections or extensions. In such cases the city will not be responsible for a lack of water for steam boilers, or for any purpose.

1792. New plumbing—repairs—pipes and traps to be exposed till after tests.] In all buildings hereafter erected in the city, both public and private, and in all buildings already built or erected wherein any plumbing is installed or wherein any sewer-connected pipe shall be repaired or changed, except for minor repairs, on the sewer side of the trap, the drain, soil, rainwater, when rainwater pipes are within building, waste pipes, or any other pipe or pipes connected directly or indirectly to any drain, soil or waste pipe, and all traps, shall be placed within buildings and exposed to view for ready inspection and test, and shall remain so exposed until approved by the commissioner of health. In no case shall a trap be inaccessible at any time.

1793. Metal connections—requirements—tests—tile sewers above ground prohibited.] All soil or waste pipes shall be connected to the tile sewer, if a tile sewer is laid within the building, and if the connection is made above the ground or floor, by a suitable metal

connection, which shall make an air-tight and water-tight joint, without the use of cement, mortar, putty or other like material, and which can and shall be tested with water when in place. Such metal connections shall be in view at the time of final inspection.

The entire fitting or piece which is used to connect the iron soil or waste pipe to the tile sewer shall be regarded as the metal connection. Metal connections which can be removed from the sewer and soil or waste pipes, after once in place without removing a portion of the iron soil or waste pipe, are prohibited. No such metal connection shall be used which has not been submitted to and tested and approved by the chief sanitary inspector and the commissioner of health. No tile sewer shall be used above the ground or cement floor or where a cement joint is exposed to the air. One of each such approved types of metal connections shall be kept in the sanitary bureau of the department of health.

1794. Connections outside buildings and under ground.] Outside of the building and under ground the connection between the soil or waste pipe and the vitrified tile sewer shall be thoroughly made with live Portland cement mortar, made with one part cement and two parts clean, sharp sand.

An arched or other proper opening shall be provided in the wall for the house drain to prevent damage by settlement. The opening around the house drain may be filled with pure refined asphaltum.

1795. Drains connected with sewers—sizes—connections must be made by plumber.]

It shall be the duty of every person or corporation connecting or causing to be connected any drain, soil pipe or passage with any sewer from any building, structure or premises, to cause such drain, soil pipe, passage or connection to be at all times adequate for its purpose and of such size and dimensions as to convey and allow freely to pass, whatever may properly enter the same.

All connections between metal pipes and between metal pipe and tile sewers shall be made by a licensed plumber and in such manner as the commissioner of health shall direct.

1796. Separate drainage for every building—exception.] Every building shall be separately and independently connected with a public or private sewer, when there is any such sewer in the street adjoining such building.

The entire plumbing and drainage system of every building shall be entirely separate and independent from that of any other building, except where there are two buildings on one lot, one in the rear of the other. If there is no sewer in the alley to which the rear building can connect, the sewer of the first building may be extended to serve such rear building.

1797. Drainage of kitchen slops, etc.—water supply.] All connections with sewers or drains used for the purpose of carrying off animal refuse from water-closets or otherwise, and slop of kitchens, shall have fixtures for a sufficiency of water to be so applied as to properly carry off such matters.

1798. Soil pipe—size—increaser.] Every water closet located within any building shall waste into a pipe not less than four inches in diameter. Such pipe shall be increased below the roof line as hereinafter provided and shall be carried through and above the roof.

1799. Definition of terms.] In this article the term "main soil pipe" is applied to any pipe receiving the discharge of one or more water closets, with or without other fixtures, and extending through the roof.

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The term "branch soil pipe" is applied to any pipe receiving the discharge from one or more water closets and with or without other fixtures and leading towards and connecting with the main soil pipe, but not necessarily extending through the roof.

The term "waste pipe" is applied to any pipe receiving the discharge from any fixture or fixtures other than water closets.

The term "house drain" is applied to the pipe within any building which receives the total discharge from any fixture or sets of fixtures, and may or may not include rain water, and which conducts or carries the same to the house sewer. The house drain, when rain water is allowed to discharge into it, shall be not less than six inches internal diameter.

The term "house sewer" is applied to the tile sewer, which shall be not less than six inches internal diameter, and which begins outside of the wall of a building and connects the house drain with the public sewer in the street.

The term "main vent" is applied to the vertical line of air pipe running through two or more floors to which the vent or revent pipes from the various floors are connected.

The term "vent pipe" is applied to any pipe provided to ventilate a system of piping, and to which the revents are connected.

The term "revent pipe" is applied to any pipe used to prevent trap siphonage and back pressure.

The term "soil vent" or "waste vent" is applied to that part of the main soil pipe or waste pipe which is above the highest installed fixture waste connection and extends through the roof.

When sizes of pipes are specified the internal diameters of the pipes are meant.

1800. Iron pipes—quality—weights.] All soil, waste and vent pipes, except as hereinafter specified for lead branches and brass pipes, shall be either extra heavy cast-iron pipe coated with tar or asphaltum, or standard galvanized wrought iron pipe; provided, that wrought iron pipe coated with tar or asphaltum may be used for soil and waste pipes, but not for soil or waste vent nor for vent or revent pipes. All pipes shall be sound and free from holes, cracks, or defects of any kind.

The following weights per lineal foot will be accepted as complying with this chapter as to weight of extra heavy cast-iron pipe:

Diameter.		
2 inches	.....	51½ pounds per lineal foot.
3 " "	.....	91½ " " " "
4 " "	.....	13 " " " "
5 " "	.....	17 " " " "
6 " "	.....	20 " " " "
7 " "	.....	27 " " " "
8 " "	.....	33½ " " " "
10 " "	.....	45 " " " "
12 " "	.....	54 " " " "

Extra heavy cast-iron pipe shall have the maker's name and the weight per foot clearly cast upon each section thereof.

The following weights per lineal foot are required for standard wrought iron pipe, galvanized, or tar-coated pipe:

Diameter.		
1½ inches	....	2.68 pounds per lineal foot.
2 " "	....	3.61 " " " "
2½ " "	....	5.74 " " " "
3 " "	....	7.54 " " " "
3½ " "	....	9.00 " " " "
4 " "	....	10.66 " " " "
4½ " "	....	12.19 " " " "
5 " "	....	14.50 " " " "
6 " "	....	18.76 " " " "
7 " "	....	23.27 " " " "
8 " "	....	28.18 " " " "
9 " "	....	33.70 " " " "
10 " "	....	40.00 " " " "

1801. Fittings—quality—cleanout fittings.] All fittings used for soil or waste pipe, except as hereinafter specified, shall be either extra heavy tar or asphaltum-coated fittings or extra heavy galvanized, cast or malleable

iron, recessed and threaded drainage fittings. The burr formed by cutting the wrought iron pipe shall be carefully reamed out. Proper sized cleanout fittings shall be installed at each ninety degree intersection of soil or waste pipe.

1802. Cleanouts—tapping pipes.] On soil or waste pipes four inches or more in diameter heavy brass cleanouts, not less than four inches in diameter, shall be used. Where iron drain, soil, waste or vent pipes are drilled and tapped, brass plugs or brass soldering nipples shall be used.

1803. Pipe joints to be filled.] All joints on cast-iron soil, waste or drain pipes and rain water leaders shall be so filled with picked oakum and molten lead and hand calked as to make them air and water-tight. The quantity of lead used shall be twelve ounces of fine soft lead for each inch in the diameter of the pipe.

1804. Vertical lines of pipes—floor rests.] Vertical lines of soil, waste or other pipes, and rain water pipes when within buildings, shall be provided with floor rests at intervals of every second floor.

1805. Pipe supports—pipe hooks prohibited.] The foot of every vertical soil, rain or waste pipe shall be adequately supported by brick, stone or concrete piers properly constructed by the use of cement mortar or cement concrete, or shall be otherwise equally well supported. Pipes under the basement floor or in the ground shall be properly laid, graded and supported. Pipes above the floor shall either be adequately supported or suspended.

The use of pipe hooks for supporting pipes is prohibited. At the foot of each soil or waste pipe shall be placed a cleanout fitting, which shall be accessible at all times.

1806. Prohibited fittings.] No double hub or straight crosses shall be used on horizontal or vertical lines. The use of bands, saddles and sleeves is prohibited.

1807. Buildings subject to vibrations—calked joints prohibited.] Pipes with calked joints shall not be installed in buildings subject to vibrations from operating machinery or subject to other causes likely to loosen such calked joints.

1808. Lead pipe—quality—not to extend within partitions.] Lead pipe of a quality equal to "extra light" shall be used for water-closet bonds and as branches for vent, revent and waste pipe connections.

Lead pipe used for vent or revent connections shall not extend into or be used within partitions.

1809. Lead pipe connections—wiped joints—brass pipes.] All connections between lead and metal pipes shall be made by heavy brass solder nipples, or heavy brass or combination ferrules which have been approved by the department of health. All solder connections shall be regulation wiped joints. If brass pipe is used it shall be drawn tubing of No. 18 B. and S. gauge.

1810. Straight tees prohibited.] Straight tees for soil or waste pipes shall not be used.

1811. Chimney ventilation of soil or waste pipes prohibited.] No brick, sheet metal, earthenware or chimney flue shall be used for a sewer ventilator or to ventilate any trap, soil, waste or other sewer-connected pipe or opening.

1812. Iron pipe—where used.] Every soil, revent, vent and waste pipe shall be of iron except as is specified herein for lead or brass pipe.

1813. Vertical pipes through roof—increased how.] The vertical soil, waste or vent pipes (where the vent or continuous waste pipe is not reconnected to a soil, waste or vent pipe below the roof) shall extend through and above the roof at least eight inches and have a diameter of at least one inch greater than that of the pipe proper; but in no case shall it be less than four inches in diameter through and above the roof.

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The increasers shall extend at least one foot below the roof. No cap or cowl shall be affixed to the top of any such pipe or pipes.

1814. Pipes above main building—nuisance.] Soil, waste and vent pipes shall be carried above the roof of the main building when otherwise they would open within fifteen feet of the windows or doors of such or adjoining buildings, and shall be not less than six feet from any ventilator or chimney opening of such or adjoining building or buildings; nor shall they be located so as to be a nuisance to the occupants of any building.

1815. Soil and waste pipes to be extended—when.] Except in office buildings and factories, branches of soil or waste pipes of twenty feet or more in length shall be extended full size, increased and carried through and above the roof. Branches of waste pipes less than twenty feet in length shall be either carried full size and increased and carried through and above roof or returned full size to the main vent pipe.

1816. Sizes of vent pipes.] Vent pipes into which the revent pipe of rows of fixtures are connected shall not be less than one and one-half inches in diameter for not to exceed three plumbing fixtures other than sink, urinal or water closets. For a greater number of such fixtures the vent pipe shall be at least two inches in diameter.

Where the vents from water closets and other plumbing fixtures are connected into the same vent pipe, the size of the vent pipe shall be at least two inches in diameter from the main vent pipe to the point of connection to the vent of the other fixtures not requiring a two-inch revent.

1817. Ejectors—sizes of vent pipes.] The soil or waste pipe leading to an ejector or other appliance for raising sewage or other waste matter to the street sewer, shall, where a water closet or closets are installed, be ventilated by a vent pipe not less than four inches in diameter. Where fixtures other than water closets are installed the waste pipe shall be ventilated by a vent pipe of the same diameter as the waste pipe. Soil vents, vents and revents for ejectors shall be installed according to the provisions of this chapter governing soil, waste, vent and revent pipes.

1818. Horizontal waste pipes prohibited—amount of pitch.] Horizontal soil or waste pipes are prohibited. In all possible cases the pitch shall be one-fourth of an inch to the foot, making the grade in the direction of the outflow.

1819. Drainage and vent fittings—prohibited vents.] Where rows of fixtures are placed in line where galvanized wrought iron pipe is used for vents or revents, galvanized iron, malleable or cast-iron fittings or cast iron drainage fittings shall be used.

All vent fittings shall be either galvanized, tarred or asphaltum coated.

Horizontal vent pipes unless practical shall not be used. Lines of soil, waste, or vent pipes shall be run in a thoroughly workmanlike manner. Trapped or sagged, or drops in, vents or revents are prohibited. No vent pipe from the house side of any trap shall connect to any sewer, vent pipe or soil or waste pipe.

1820. Continuous vents—ventilation of traps—crown venting prohibited.] Trap revents shall be continuous where possible. Where the vent or revent pipes are continuous and traps are ventilated through the waste fitting, the center of the outlet of such fitting shall not be set below the water seal of the trap; and the trap shall not be more than three feet from the waste fitting.

No crown venting shall be permitted.

1821. Size of soil and waste pipes.] The least diameter of soil pipe permitted is four inches. A vertical waste pipe into which a kitchen sink or sinks discharge shall be two inches in diameter, and at least three inches in diameter if receiving the waste of five or

more floors, and shall have not less than one and one-half inch branches.

1822. Trap prohibited—where.] There shall be no traps at the foot of soil or waste pipes, nor shall there be any trap upon the house drain or house sewer.

This section shall not prohibit the use of traps at the foot of rain water leaders or upon drains or sewers used exclusively for conducting rain water to a public sewer.

1823. Trap revents—concealed partitions.] Every water-closet, urinal, sink, basin, bath, and every laundry tub or set of laundry tubs, or any other plumbing fixtures shall be effectively and separately trapped and revented, except as hereinafter provided for anti-siphon traps.

All traps shall be protected from siphonage by special vent or revent pipes, except where anti-siphon traps are permitted. Such revented trap shall not depend upon any concealed partition for its water seal.

1824. Connected wastes.] A connected waste pipe receiving the discharge of not more than two basins, set in line, may waste into a single trap, which shall not be more than two feet from the waste outlet of one of the fixtures.

1825. Floor washes—prohibited traps—back water valve.] When floor washes are connected it shall be by means of a deep seal trap. Bell traps and cast-iron S. and P. traps having covers over hand holes on the sewer side of the trap, held in place by lugs or bolts, are prohibited. When a floor drain is placed in a basement, it shall be protected from back sewage by means of some suitable and approved back water valve or stop. Covered floor gutters are prohibited.

1826. Bath tub drum trap—revent.] Each bath tub shall be provided with a drum trap. Traps on bath tubs shall be placed in such a manner that the cleanout will be in plain view and above the floor. The drum trap shall be revented through either a "TY," a "Y" or a drainage fitting.

1827. Traps—placing of—water seal.] Traps shall be placed as near to the fixtures as possible, and in no case shall a trap be more than two feet from the waste outlet of its fixture.

All traps shall have at least a one and one-half inch water seal and they shall be set true with respect to their water level.

1828. Waste pipe connection with closet bend, etc., prohibited—exception.] In no case shall a waste pipe from any fixture be connected with any water-closet trap, lead bend, vent or revent connection for same, except that a waste connection may be made to a lead bend in old or repaired work.

1829. Water closet revent—size.] Water closets when placed within buildings shall have two-inch revents for each water closet trap, except as hereinafter provided.

1830. Sizes of vent pipes—revents.] The main vent pipe for traps of water-closets in buildings four stories or under shall be at least two inches in diameter and have two-inch revents, except that revents for the traps of other plumbing fixtures may be the same diameter as waste traps. In buildings more than four stories high and not more than six stories high, the main vent pipes for water-closets with or without other plumbing fixtures shall be at least two and one-half inches in diameter. In buildings more than six stories high and not to exceed eighteen stories, the main vent pipes for water-closets with or without other plumbing fixtures shall be at least three inches in diameter. In buildings more than eighteen stories high the main vent pipe for water-closets with or without other fixtures shall be at least four inches in diameter. The main vent pipe for other fixtures than water-closets in buildings four stories and under shall be at least two inches in diameter. In buildings more than four stories high and not more than eight stories high the main vent pipes shall be at least two and one-half

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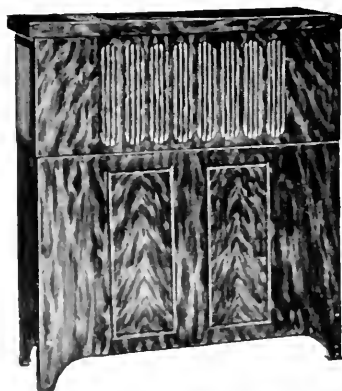
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inches in diameter. In buildings more than eight stories high the main vent pipe shall be at least three inches in diameter, except that the diameter of the vent pipe may be reduced to two and one-half inches for the six lower stories; provided, that where the waste pipe for fixtures other than water-closets exceeds three inches in diameter the main vent pipe shall be at least three inches in diameter. The size of revent to traps of plumbing fixtures other than water-closets shall be at least the same size as waste to traps.

1831. Vents—size of for twelve fixtures.] Where more than twelve closets are installed on any floor the vent pipe for the same shall be at least three inches in diameter with two-inch revents for traps.

For purposes of reventing, any four fixtures other than water-closets (where the same are placed on one floor) shall be taken as equal to one water-closet. This is to apply where water-closets are revented through the same vent pipe.

1832. Vents in residences.] Vent pipes for water-closets in residences shall be two inches in diameter with same size branches, and for other fixtures not less than one and one-half inches in diameter with branches the same size as waste and trap; except that the vent pipe for a kitchen sink shall be two inches in diameter.

1833. Sizes of waste pipes in buildings over four stories in height.] Where fixtures other than water-closets are installed in a building more than four stories and basement or cellar high, having no soil pipe from ground in building to and through roof, and where the total number of fixtures wasting into one pipe exceeds six, the same shall waste into at least a two and one-half inch pipe, which shall be carried through the roof; except that where a battery of urinals and no water-closets are installed in any building (where a three-inch waste pipe is required) the same shall be carried at least three inches in diameter from the ground in the building up and through the roof.

1834. Sizes of waste pipes in buildings four stories in height and under.] In buildings of four stories and under, where no water-closet is installed and where no sewer-connected soil pipe is carried from ground in building to roof, the fixtures if six or more in number shall waste into a pipe at least two and one-half inches in diameter, which shall be carried through the roof.

Where a smaller number of fixtures is installed the main waste pipe shall be two inches in diameter and carried through the roof, except that where a battery of urinals having a three-inch waste pipe is installed the waste pipe shall be carried at least three inches in diameter from the ground in the building up and through the roof.

1835. Vents reconnected—connections prohibited with floors below.] All vents shall be either run separately through the roof or be reconnected to an increaser twelve inches below the roof, or they may be reconnected to the soil vent or main vent pipe not less than three feet above the highest floor on which fixtures are placed; provided, that no fixture or fixtures shall be placed on any floor or floors above and connected to the soil, waste, vent or revent pipes from the fixtures on floors below; nor shall any fitting or fittings for future connections be placed in any soil or waste pipe above the point of revent connection. Where fixtures are afterwards installed on other floors the vent and revent pipes of the fixtures already installed shall be rearranged to conform to the provisions of this chapter. Reconnections will not be permitted where said vent pipes run through more than five floors.

1836. Length of horizontal vents.] Except in office buildings and in factories, the vent pipes from any fixture or fixtures reconnected as hereinbefore provided, shall not span a horizontal distance to exceed twenty feet in length. In office buildings and fac-

ories this distance shall not exceed forty feet.

1837. Vent pipe increased.] Where a vent pipe is carried independently through the roof it shall be increased as provided for in preceding sections.

1838. Prohibited use for revents, etc.] No trap, revent or vent shall be used as a waste or soil pipe.

1839. Revents for adjoining fixtures.] Where bath rooms are located on opposite sides of a wall and directly opposite each other and on the same floor in any building and have a common soil or waste pipe in the same separating wall, the revents from fixtures in either or both of such bath rooms may connect into the same pipe.

Where two plumbing fixtures, other than water closets, waste into a double "Y" or double "TY" fitting, a single proper revent connected at or near the junction of the two waste lines forming a part of the fitting will be permitted.

1840. Safe wastes.] All lead or other safes where necessary under fixtures shall be drained by a special pipe, the same to discharge into an open water supplied sink or into a deep seal trap, and in no case shall the safe be connected with any waste, soil or drain pipe or sewer. The ends of safe waste pipes shall be covered by flap valves.

1841. Overflow pipes—how connected.] Overflow pipes from fixtures shall be in each case connected on the inlet side of the trap.

1842. Refrigerator wastes—sizes—traps.] The waste pipe from a refrigerator or ice box shall not be directly connected with any soil, rain or waste pipe or with the drain or sewer, or discharge upon the ground. It shall discharge into an open water supplied sink or over a deep sealed trap and shall be as short as possible and disconnected from the refrigerator or ice box by at least four inches; and where refrigerators or ice boxes are placed in buildings and upon two or more floors, the waste and vent pipe thereof shall be continuous and shall run through the roof and in no case shall it open within six feet of an open soil or vent pipe.

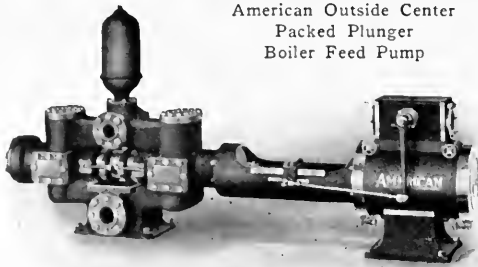
The size of a waste pipe for refrigerators for two floors or less shall be at least one and one-half inches, and two inches for three floors and over and under five floors, and two and one-half inches for five floors and over. Each refrigerator or ice box shall be provided with a suitable trap with an accessible trap screw or clean-out. Such trap shall be placed in the one and one-half inch waste pipe and shall be near the refrigerator or ice box. Such traps need not be separately revented.

1843. House boilers—sediment pipes.] The sediment pipe from house boilers shall not be connected into the sewer side of any trap nor directly connected into any soil or waste pipe or drain.

1844. Water closets—flush tanks—purity of water.] All water closets and urinals within any building shall be supplied from special tanks or approved automatically flushing valves having flush pipes at least one and one-quarter inches in diameter. The water from such tanks or cisterns shall not be used for any other purpose. The purity of such water and of water used in all other plumbing fixtures shall be equal to the purity of the water supplied through the Chicago waterworks system.

1845. Automatic flush tanks for urinals.] Flush tanks for urinals shall be arranged for intermittent and automatic discharges. All urinals shall be flushed at regular intervals not to exceed seven minutes each.

1846. Cisterns for water closets—siphon discharge—house tanks.] Where cisterns are used for water closets they shall each have a siphon discharge. The valves of such cisterns shall be fitted and adjusted so as to prevent a waste of water. When the city pressure is not sufficient to supply such cisterns or plumbing fixtures with water, ade-



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quate pumps or house tanks shall be provided.

1847. Water closets within buildings—flushing rim bowls.] All water closets within buildings shall have flushing rim bowls.

1848. Water closets within buildings—flushing discharge.] Water closets and urinals within buildings shall not be supplied from any water supply pipes direct.

All water closets within buildings shall be fitted with either siphon discharge flush or pressure tanks or approved automatically flushing valves not directly connected to the city water supply pipes.

All individual water closets within buildings at each flush shall receive not less than four gallons of water into the closet bowl at each discharge, which shall be discharged in such time and with such force as shall thoroughly clean the closet bowl at each flush.

1849. Long hopper closets—regulations.] Long hopper closets shall not be installed within any building hereafter constructed. Long hopper closets may be installed in a cellar or unfinished basement of old or existing buildings only. A water closet in a basement or in a yard may be flushed with a hopper cock or stop and waste cock buried to a depth of at least three feet below the ground. A long hopper closet of the last named construction shall be located at least eight feet distant from any dwelling.

A flushing rim water closet may be placed adjacent to the outside wall of an existing building when the occupied floor of the building is not more than two feet above the ground level, in which case such closets shall be flushed by suitable flushing cistern, the flushing pipe from which shall be brought nearly to the level of the closet seat on the inside of the building.

1850. Outside water closets—where prohibited—regulations.] A water closet shall not be installed on a porch or other like place. Outside water closets may be installed for buildings heretofore erected only.

Water closets when placed in the yard of any building heretofore erected shall be separately trapped and placed not less than eight feet from any dwelling or other place of abode and so arranged as to be conveniently and adequately flushed, and their water supply pipes and traps shall be protected from freezing. The compartments for such water closets shall be adequately lighted and ventilated.

1851. Water closets under sidewalks, etc.] Where water closets or other plumbing fixtures are placed under a sidewalk, street, alley or other like place, adjoining and opening into the basement of any building, each and every fixture so placed shall be ventilated in the same manner as is provided for other plumbing fixtures in this chapter, and the water closet compartments shall be adequately lighted and ventilated.

1852. Places of employment—separate water closets for men and women—number.] In all places of employment where men and women are employed, separate and sufficient water closets shall be provided for males and females. Water closets for men shall be plainly marked "Men's Toilet" and water closets for women shall be plainly marked "Women's Toilet."

In all places of employment, one water closet shall be provided for every twenty-five males or less number, and one water closet shall be provided for every twenty females or less number. Such water closet facilities shall be furnished upon at least every second floor. Where there are employees in any basement, such basement shall be considered as one floor.

1853. Water closets in hotels and lodging houses.] In lodging houses and hotels hereafter erected or altered there shall be provided one water closet for every twenty-five males or less number and one water closet for every twenty females or less number.

The number of water closets required shall be determined from the number of lodging quarters provided. There shall be at least one closet on each floor. The general water closet accommodations of a lodging house shall not be placed in the basement.

1854. Separate closets in buildings used for both business and residence purposes.] In all buildings used jointly for residence and business purposes, separate and sufficient water closets shall be provided for the use of families and for the use of employees and patrons of the place.

1855. Toilet paper.] No paper other than what is commonly known as toilet paper shall be placed in any water closet or allowed to enter any soil pipe.

1856. House tanks—zinc and lead linings prohibited—overflow pipes.] Tanks in which water to be used for drinking or other domestic purposes is stored shall not be lined with zinc or lead.

The overflow pipes from such tanks shall discharge upon the roof or be trapped and discharged into an open sink. Such overflow pipes shall not be connected into any soil waste pipe or other sewer connected pipe; nor shall the drain or sediment pipe be connected into any soil, waste or other pipe directly connected with a sewer.

1857. Rain water leaders—prohibited uses—when to be trapped—construction.] Rain water pipes or leaders shall not be used as soil, waste or vent pipes; nor shall any soil, waste or vent pipe be used for a rain water pipe or leader. Where a rain water leader opens near any window, door or vent shaft, or is so located as to render it likely to become a nuisance, if not trapped, it shall be properly trapped far enough below the surface to prevent its becoming a nuisance or freezing.

Inside rain water leaders shall be made of extra heavy cast iron or tar or asphaltum coated wrought iron or galvanized wrought iron pipe, with roof connections, made gas and water tight by means of heavy lead or copper drawn tubing, wiped or soldered to a brass ferrule, calked or screwed into the pipe. Outside rain water leaders may be of sheet metal but they shall connect with the house drain by means of a five-foot length of cast iron pipe extending vertically at least four feet above the grade level.

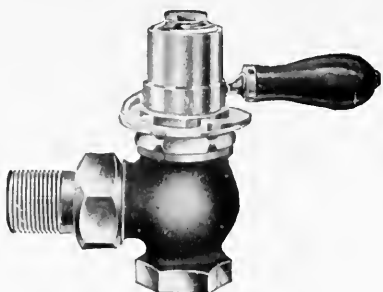
1858. Steam pipes—condensers—vents.] No steam, exhaust, blowoff, drip or return pipe from any steam trap shall connect with the sewer or with any house drain, soil, or waste pipe or rain water pipe. The water or steam of condensation from such pipes, before it shall enter any sewer or drain, shall be discharged into a suitable cast iron catch basin or condenser, from which a special vent pipe not less than two inches in diameter shall extend through the roof.

1859. Blowoff pipes—how made—discharge.] Blowoff pipes from boiler or heating plants shall be either of extra heavy cast iron pipe or galvanized wrought iron pipe. No such blowoff or hot water pipe shall discharge directly or indirectly into any vitrified earthenware tile sewer within any building.

1860. Temperature of water entering sewer.] No water of a higher temperature than one hundred and twenty degrees Fahrenheit shall be permitted to enter any house sewer direct.

1861. Area drains to be trapped—when.] When the area drains are connected to the house sewer or drain, they shall be effectively trapped. Such traps shall be protected from frost.

1862. Cellar drainer—ground water.] Cellars and basements shall be kept free from ground or surface water, and where the same are too low to be drained into the sewer, the water therefrom shall be lifted by a cellar drainer or other device, approved by the chief sanitary inspector, and discharged into the sewer.



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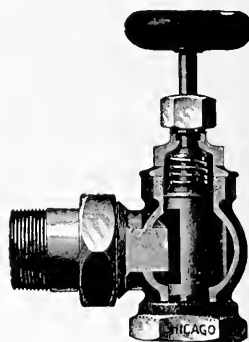


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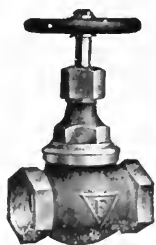
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1863. Floor washes in basements—building plans must indicate locations of backwater valves.] Floor washes for basements shall be provided with a deep seal trap, having a heavy strainer, and a backwater gate valve, or stop, accessible for cleaning. No backwater valve shall be used which has not been approved by the chief sanitary inspector.

All building plans, where basement floor washes are connected, shall indicate where and what backwater valve or device is to be used.

1864. Sumps—tight cover.] Sumps or rodding basins for subsoil drains shall be provided with tight cast iron covers.

1865. Wood sinks and tubs prohibited.] The installation of stationary wooden sinks and wooden laundry tubs is prohibited inside of any building used for human habitation. Such sinks and tubs shall be of non-absorbent material.

1866. Catch basins prohibited within buildings—exceptions.] No catch basin or gravel basin shall be allowed within any building, except as provided for in the following sections.

1867. Catch basin to intercept kitchen wastes—diameter.] Kitchen or other greasy wastes shall be intercepted by a catch basin or grease trap and thence conducted to the house sewer.

The vitrified tile sewer through which kitchen wastes are conducted shall be at least six inches in internal diameter.

1868. Catch basins for kitchen wastes—construction—covers.] Catch basins for receiving such wastes shall be constructed either of brick, concrete or cast iron. If of brick or concrete, they shall be at least thirty inches in internal diameter at the base and may taper to not less than twenty-two inches internal diameter at the top.

Each catch basin shall be covered at the grade level with a stone, iron or cement concrete cover, having an opening of sixteen inches diameter, and fitted with an eighteen inch iron lid of a weight not less than eighteen pounds. No stone cover shall be less than three inches in thickness. No wooden catch basin cover shall be hereafter installed. If a wooden catch basin cover becomes rotten or defective so as to require repair or replacement, it shall be removed and replaced with a stone, iron or cement cover placed at the grade level.

Every concrete cover hereafter installed shall, if not reinforced as hereinafter provided, be made at least three and one-half inches thick from a Portland cement concrete mixture consisting of one part cement, two parts limestone screening free from clay, and three parts number three crushed limestone such as will pass through a three-quarter inch sieve. The use of clean torpedo sand entirely free from dirt shall be considered the equivalent of the two parts of limestone screening in this mixture.

Every reinforced concrete cover shall be not less than three inches in thickness, made of the mixture above described, and shall be reinforced with two hoops of not less than gauge number ten wire, having the respective diameters of twenty and twenty-eight inches, and provided with at least eight cross connections of the same wire between the inner and outer hoops.

All covers shall be manufactured under shelter, protected from the sun, wind and frost, and shall not be removed from such shelter for at least two weeks after manufacture.

The walls of such catch basin, if of brick, shall be eight inches thick and laid in Portland cement mortar and plastered outside and inside with a half-inch coat of Portland cement mortar in proportion of one part of Portland cement and two parts of clean, sharp sand. The bottom shall be at

least eight inches thick and of either brick laid in cement mortar or of Portland cement concrete. The brick used shall be hard burned sewer brick.

Where Portland cement concrete is used, the walls shall be at least five inches thick, and the concrete shall be made of one part of five Portland cement, three parts of clean, sharp sand, and four parts of crushed stone free from dust and of sizes between one-fourth inch and one and one-half inches in largest diameter; and, in addition, the catch basins shall be plastered inside and out, as specified above for brick construction. Catch basins shall be made water tight. No re-tempered cement shall be used.

The bottom of catch basins shall be at least two feet below the invert of the outlet to the sewer.

The outlet shall be trapped to a depth of six inches below the invert of the outlet to the sewer to prevent the escape of grease, by a hood or trap of brick and cement mortar, or a hood of concrete or cast iron.

The invert of the inlet to the catch basin for kitchen wastes shall be not less than two and one-half feet above the finished bottom of the catch basin.

1869. Catch basin dispensed with—grease trap.] Where the building covers the entire lot, the catch basin for kitchen wastes may be dispensed with; provided, that a suitable sized grease trap of approved construction is installed and provided with a water jacket through which shall circulate the water that is drawn for the general kitchen use. Such grease traps shall at all times be accessible for cleaning.

1870. Rain conductor connection—defective catch basins.] Rain water leaders may connect to catch basins. Such leaders shall connect to a catch basin when they conduct water from a gravel roof.

Defective and leaking catch basins shall be rebuilt according to the above specifications.

1871. Number of urinals in factories.] In all places of employment, one urinal shall be provided for every seventy-five males or less number.

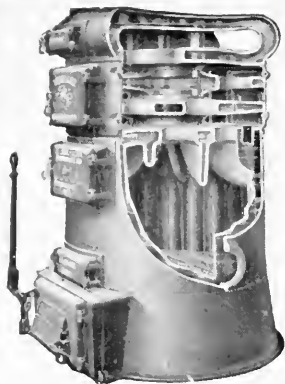
1872. Urinals—construction—prohibited use.] The sides, back and base of every urinal stall placed within any building shall be of non-absorbent material. Urinal stalls having troughs set in the floors are prohibited. The top of the urinal base shall be set one and one-half inches above the finished floor level. Urinal troughs and sectional urinals, unless lipped and provided with suitable automatic flush tanks or approved intermittent and automatic flushing valves, are prohibited. No sectional urinals shall be placed within a building or compartment which is subject to vibrations.

1873. Urinal flush—prohibited materials—separate trap and waste pipe.] Every urinal stall shall have an individual lipped sanitary urinal bowl.

The use of cast iron, galvanized iron, sheet metal or steel urinal bowls and troughs is prohibited. Each urinal bowl shall be separately and independently trapped and shall have a waste pipe of at least two inches in diameter.

1874. Automatic flushing of urinals—frequency.] Each and every urinal trough and urinal bowl shall be intermittently and automatically flushed with at least one gallon water flush for each urinal bowl or two foot length of urinal trough and at intervals not to exceed seven minutes each during its period of use.

The flushing of all such urinal fixtures shall be by means of either approved intermittently and automatically operated flush tanks or by intermittently and automatically operated flushing valves protected against a vacuum by a ground seat check valve.



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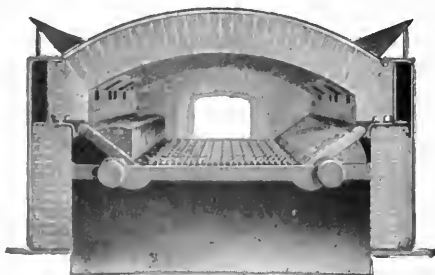
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1875. Urinal wastes—screens.] The waste pipe of a "battery" of not exceeding four urinals shall not be less than two inches in diameter. For batteries exceeding this number the waste pipe shall be at least three inches in diameter.

No wire or metal screen shall be placed in any urinal bowl, unless every part of such screen is thoroughly washed at each water flush.

1876. Revent omitted—when.] Where a single water closet or other plumbing fixture is located in a building or on the top floor of any building, and there is an adequate soil or waste pipe of undiminished size from ground (in building) to roof, the revent pipe may be dispensed with; provided, that for water closets a non-siphoning trap, tested and approved by the chief sanitary inspector, or a closet of approved construction, is used for such work; and provided, further, that the trap of such fixture is located not more than five feet from such soil or waste pipe.

1877. Revent omitted—when.] Where a toilet or bath room having not more than one closet and three other fixtures therein is located on one floor only or the top floor of any building, and such closet is set not more than five feet from the vertical soil pipe, the revent for the closet may be omitted; provided, that a closet of an approved construction is installed.

1878. Vent pipes reconnected—exception.] Vent pipes shall be reconnected to main soil and waste pipes or drain by a "Y" branch below the lowest fixture, and in such manner as to prevent accumulation of rust. This shall not apply where there is a battery of fixtures on one floor only and no other fixtures on floors above or below.

1879. Open plumbing.] All plumbing fixtures shall be installed as open plumbing.

1880. Prohibited closets—removal.] Pan, plunger, offset, wash-out-range closets and washout latrines shall not be allowed in any building; nor shall hopper closets be installed in any building hereafter erected. Such closets, when found to be a nuisance, shall be removed, or when the same are removed for repairs they shall not be again installed. In alteration work, pan and plunger closets shall be removed.

Range closets of types approved by the commissioner of health and the chief sanitary inspector may be installed in factories and workshops only, and such closets shall be installed in separate compartments as hereinbefore provided for water-closet compartments.

1881. Reventing washout closets.] Where individual washout closets are installed they shall be revented above the floor line. Rubber connections or connections of like material shall not be used on any sewer connected pipe.

1882. Prohibited fixtures not reinstalled.] No fixture shall be installed and no fixture shall be reconnected or reinstalled where it does not meet the requirements of this chapter.

1883. Earthenware trap connections—how made.] All earthenware and closet traps shall be connected to waste or soil pipes by inserting heavy brass floor or wall flanges, not less than one-fourth of an inch in thickness where lead bends are used, and shall be soldered to the same and bolted to the trap flange.

Where brass or iron bends are used, brass or iron flanges not less than one-fourth of an inch in thickness may be used, and shall be screwed or calked to the same and bolted to the trap flange, and all such joints shall be made tight without the use of putty, cement, plaster, rubber or leather washers. The use of putty, cement, plaster, rubber or leather washers is hereby prohibited in making all connections between

traps of plumbing fixtures and soil or waste pipes.

No flange, iron bend or gasket connection shall be used until it has been approved under test by the chief sanitary inspector. One of each of the above type of gaskets, flanges and iron bends shall be kept on exhibition in the sanitary bureau of the department of health.

1884. Slip joints—ground joints.] Slip joints shall not be permitted on the sewer side of any trap, unless the metal connection is required between the soil or waste pipe and the sewers. Unions on wrought iron, soil, waste and vent pipes shall be made by means of metallic brass-seated ground unions, or flange unions with sheet lead gaskets, and made without other gaskets or packing.

1885. Barn drainage—traps—catch basins.] Floor washouts, urinal gutters and wash racks in barns or stables shall be provided with deep seal traps, having heavy strainers. Such traps shall have a depth of seal of at least three inches and shall be located at the floor line. An adequate water supply shall be provided for flushing such gutters.

All liquid wastes from barns or stables shall be intercepted before entering the sewer by a catch basin placed outside of the building, which shall be either the catch basin which is constructed according to the specifications for such catch basin or a cast iron catch basin provided with bolted airtight iron cover. Barn drains and wastes shall be ventilated by sufficient and proper vents through the roof.

1886. Special permits—when issued.] Special permits will be issued by the chief sanitary inspector only.

Where special permits are issued, the location shall be inspected before the work is started, and duplicate plans in ink, in the name of the owner, agent or architect, shall be submitted and approved and placed on file. These plans shall show the proposed work, in plan and elevation. Such plans shall be drawn on paper or cloth and drawn to a quarter inch to the foot scale.

The installation of any sewer connected fixture or of any sewer connected pipe or pipes other than those hereinbefore mentioned, or under any other conditions than those hereinbefore set forth, shall be as directed by the chief sanitary inspector, and the same shall be covered by special permits issued by him.

1887. Plumber's notification—inspection—when.] When the plumbing in any building is ready for inspection, the plumber in charge of the work shall immediately notify the commissioner of health in writing of such fact at least twenty-four hours in advance of inspection. Inspections will not be made the same day that notifications are received.

1888. Inspection of repairs.] The following repairs and extensions to any part of the plumbing and drainage system in any building shall also be reported for inspection, viz., where there is any change in any sewer connected pipe, and where such change is on the sewer side of the trap, except in the case of minor repairs.

1889. Inspection—test.] The entire plumbing system, when roughed in, in any building, shall be tested by the plumber in the presence of the plumbing inspector and as directed by him, under either a water pressure or air pressure.

The water pressure test for plumbing shall be applied by closing the lower end of the vertical pipes and filling the pipes to the highest opening above the roof with water. The air pressure test for plumbing shall be applied with a force pump and mercury column equal to ten inches of mercury. The use of spring gauges is prohib-



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ited. Special provision shall be made to include all joints and connections to the finished line or face of floors or side walls, so that all vents or revents, including lead work, may be tested with the main stacks. All pipes shall remain uncovered in every part until they have successfully passed the test. After the completion of the work, and when fixtures are installed, either a smoke test under a pressure of one inch water column shall be made of the system, including all vent and revent pipes, in the presence of the plumbing inspector and as directed by him, or a peppermint test made by using five fluid ounces of oil of peppermint for each line up to five stories and basement in height, and for each additional five stories or fraction thereof one additional ounce of peppermint shall be provided for each line.

All defective pipes and fittings or fixtures shall be removed and all defective work shall be made good so as to conform to the provisions of this chapter.

The tile drainage system inside any building shall be tested by the drainage layer or sewer builder, in the presence of the house drain inspector, by closing up the end of the drains two feet outside the building and filling the pipes inside the building with water to a height of at least two feet above the highest point of the tile drainage system.

1890. Water closet and urinal compartment—ventilation.] Water closets and urinals shall not be installed in an unventilated room or compartment. In every case the room or compartment shall be open to the outer air or be ventilated by means of an air duct or shaft or be mechanically ventilated.

Where a urinal, bath or water closet compartment is mechanically ventilated, the air shall be changed at least four times per hour by exhausting the air from the compartment.

In the case of an extension or alteration of any existing plumbing system, the same, if new stacks are run, shall be tested when roughed in and when completed, as hereinbefore provided.

1891. Peppermint test for alterations.] In other alteration work, a peppermint test, and only this test, shall be applied by using five fluid ounces of oil of peppermint for each line up to five stories and basement in height, and for each additional five stories or fraction thereof one additional ounce of peppermint shall be provided for each line.

1892. Old work remodeled.] In remodeling work, the existing system of soil, waste and ventilating pipes shall be changed to make them reasonably conform to the provisions of this chapter.

1893. Light and ventilation.] All urinal, bath or water closet compartments, hereafter constructed in any building, shall be lighted and ventilated as hereinafter provided for in this chapter. Every water closet or urinal compartment or bath room in every now existing building, and every compartment in buildings hereafter erected, where the compartment is more than one story under ground, shall be separately ventilated by a window opening to the external air or by proper and adequate ventilating pipes, shafts or ducts running through the roof or to the external air, and providing for at least four changes of air for the entire compartment each hour. All such compartments shall be adequately lighted by either natural or artificial light.

1894. Toilet compartments—separate.] The urinal, bath or water closet compartments shall be separate compartments and shall be entirely separated from any other room, workshop, office or hall by a tight partition extending from floor to ceiling, and

every door of every such compartment shall be provided with a door check to keep such door closed.

No window or other opening shall be made to open from any such compartment for the purpose of ventilation, into any adjoining room, office, workshop, factory, hallway or compartment of any kind.

1895. Window area in toilet compartments.] In every building hereafter constructed, every such compartment, where there is not more than one story under ground, shall have a window not less than one foot wide and of an area of at least four square feet for a floor area of forty-five square feet or less, opening directly into the outer air, or special light and air shaft, into which no other rooms or compartments, other than toilet compartments, are ventilated. For upwards of forty-five square feet of floor area there shall be a window area of at least one-tenth of the floor area. The windows in all cases are to be arranged so as to admit of their being opened at least one-half their height. The urinal, bath or water closet compartments on the top floor of any building may be lighted and ventilated by means of a skylight and ventilator. The area of the skylight shall conform to the above specified areas for windows.

1896. Fixtures to be kept in sanitary condition.] All such fixtures in such compartments as are referred to in the previous section shall be kept in a thoroughly clean and sanitary condition.

1897. Ventilation into court.] Nothing herein contained shall be construed as preventing the ventilation of the above mentioned compartments into an outer, inner or lot line court.

1898. Plans—plan and elevation, etc.] Building plans in duplicate shall be filed with the bureau of sanitary inspection before the original plans are approved. Such duplicates shall be on paper or cloth and drawn to a standard scale, showing how all rooms and compartments of the building are to be lighted and ventilated. They shall also show in plans and in at least one elevation all drains, soil, waste, vent and revent pipes within the building and the location of all plumbing fixtures within the building, the location of the catch basin (in case one is necessary) outside of the building, and its connection to the drainage and sewerage system.

1899. Fee before plans are approved.] Before plans are approved, the following fees for inspection shall be paid to the city collector:

When the building contains from one to six plumbing fixtures, the sum of fifty cents shall be paid for the inspection of each fixture, and for each and every additional fixture thereafter installed, or for which waste or vent fittings are installed, the sum of twenty-five cents shall be the fee for inspection.

1900. Certificate of inspection.] When the plumbing in a building is completed, the plumber or his representative shall secure for the owner of such building, from the commissioner of health, a certificate of inspection, signed by the chief sanitary inspector and approved by the commissioner of health, certifying that the plumbing work has been properly inspected and tested as required by the provision of this chapter.

1901. Penalty.] Any person or corporation who shall violate any of the provisions of this chapter shall be fined not more than two hundred dollars nor less than twenty-five dollars for each offense; and a separate and distinct offense shall be regarded as having been committed each day on which such violation shall be allowed or suffered to continue after the first offense.

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VARNISH—ITS MANUFACTURE, USE AND APPLICATION

In the manufacture of varnishes few of the various grades made require more scientific knowledge, skill and experience throughout the entire process of manufacture than those known as "Architectural Varnishes" (the term understood to mean "Oil Varnishes" and it represents those of high quality for architectural work). They may be classified into three general divisions, having various subdivisions, known as "Long Oil Varnish," "Short Oil Varnish" or "Medium Oil Varnish," according to the proportion or amount of linseed oil to the resinous content, that is the proportion of oil and gum necessary to form a staple compound, may vary only to a certain point, either way, conditional upon the percentage of resinous matter contained in the gum. These varnishes consist of melted gums, linseed oil, drying agents, such as turpentine and naphtha, a slight variation existing in the quality and kind of these ingredients.

The gums which form the basis require care in their selection and the sorting or grading of each kind. The principal gums used are the "Copals," the name applied to gums of fossil origin imported from Africa. Then we have the "Kauri Gums." They are of vegetable origin and imported from New Zealand. These gums differ from each other in hardness and color, their use in the production of varnish being determined by the conditions the finished product is designed to meet.

Linseed oil is quite as important a factor as the gum itself. It is required to undergo special treatment before it is applicable for use in the manufacture of varnish. Every particle of albumenoid and mucilage must be removed. Then, too, China wood oil after undergoing treatment is used in connection with linseed oil, for its superior hardness, durability, elasticity and moisture resisting properties. The supply is imported from China.

There are also the cheap varnishes which must be put in a class by themselves, for not only do they not contain hard gum or linseed oil or at best a very little of either, because of the large amount of common resin they contain.

In view of the varying qualities of varnish ingredients and their susceptibility to atmospheric conditions, much depends upon the skill and honesty of the manufacturer. Although the advance in technical instruction and scientific knowledge tends to foster competition, varnish is an article in the use of which entire confidence is a matter of necessity. To merit this confidence makes the establishment of a brand the work of years, if not generations, and then only possible of attainment by long experience, technical knowledge, diligence and exactness of manufacture.

The requirements of a good varnish are that it be easily applied. It should dry properly in a uniform, durable film, adhere persistently to the object to which it is applied and elastic enough to yield or stretch within reasonable limits. It should not melt or run under heat of the sun, neither should it be brittle under the influence of cold. In general, a light colored product is desired and the properties on which a finishing varnish will have to depend are the quality and proportion of oil and gum of which it is composed.

In the field of architectural varnishes there is a demand for materials of different characters, known as "special finishes." They have become an important factor in the work of wood finishers and decorators. Accord-

ing to their particular use, architectural varnishes may be classified as "Interior," "Exterior" and "Floor Varnishes." Floor varnish and spar or exterior varnishes must be designed to withstand the severe wear to which they are subjected, and only one grade should at any time be considered, and that is the best that can be made, whether for cheap or high grade work, ultimate economy being the object. In the case of interior varnishes, one must be light in color, for the lightest woods and tints, one must rub, one must polish and one must dry flat. These conditions, so antagonistic to the other, demand varnishes of totally different character. In short, it is necessary to use a specific varnish for each particular finishing requirement to insure best results.

It is practically impossible for the architect to be familiar with all details of varnishes and their application. He is obliged to rely upon his general knowledge of wood finishing and the data placed in his hands by the manufacturer. In order to eliminate as far as possible any negative condition to good wood finishing results, one must select a house of good reputation, as honesty along with skill and experience on the part of the varnish manufacturer, insure good products. Price must also be considered. It determines the quality of varnish and is also applicable to workmanship, for quoting from Ruskin, "All works of quality must bear a price in proportion to the skill, time, expense and risk attending their invention and manufacture. Those things called dear are, when justly estimated, the cheapest. They are attended with much less profit to the artist than those which everybody calls cheap."

Varnishes are required to meet hard and varying conditions and when a finished project does not come up to the expectations, the responsibility is, as a matter of course, usually attributed to the varnish, but in such cases of complaint and particularly where the varnish used is one of high quality, and adapted for that particular kind of work on which it was applied, it is usually found upon investigation that some condition foreign to the varnish is responsible for the trouble and not the varnish.

The application of varnish requires more than ordinary brush work. It requires a thorough knowledge of the various varnishes adapted for different kinds of work, the conditions detrimental to producing good results and how to avoid or overcome them. Therefore the architect should be satisfied that the workman entrusted with the finishing of his project is experienced in the handling of varnish. The finest varnish produced will not give satisfactory results unless that varnish is properly applied on work for which it is designed, under favorable conditions.

Conditions detrimental to satisfactory finishing results generally found the basis of complaints on varnish and the effects resulting therefrom may be summed up as follows:

First: Unsuitable undercoats such as shellac, liquid filler or cheap varnish. They have a tendency to cause the finishing varnish to "turn white" and also affect the durability of the finish despite its being protected with a high quality, elastic, durable finishing varnish. This trouble may be avoided if the architect will insist that the varnish specified for the work shall be used for the various coatings.

Second: The application of a coat of varnish before the preceding coat is thoroughly dry. "Cracking" of the finishing coat is the

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resulting effect, assuming that the finishing varnish is one of high quality and adapted for the work. In order that this cause and effect may not be confused with the term "Brittleness," it is perhaps well to explain that "Brittleness" is an inherent defect in the varnish, caused by an excess of dryer, lack of oil or by adulterated materials having been used in the manufacture. If a varnish powders white under the friction of a finger or easily scratches white, it is incontrovertible evidence of poor quality. Brittle varnishes are liable to crack when exposed to sudden changes of temperature. These varnishes should be avoided for it is poor economy to use them in any event as the labor cost of application is practically the same whether a high grade or an inferior quality of varnish is used, in fact, the labor expense of applying a poor quality of varnish is greater than that of applying a high quality varnish, because the workman has of necessity to consume more time in the application of the poor quality article as it does not possess the working qualities or covering capacity of the high quality product.

Third: The application of too heavy coats. This produces a condition known as "Wrinkling," "Cramping" or "Sagging." These conditions will also ensue when varnish is exposed to sudden change of temperature while in the process of drying or when the final coat is applied over an undercoat not thoroughly dry.

Fourth: Rubbing the undercoat before it is thoroughly dry. This is sometimes done to hasten the work and invariably causes the condition known as "Sweating" which means the reappearance of lustre on the surface. The application of a finishing coat before the undercoat is thoroughly dry as well as rubbing a finishing varnish not designed to be rubbed will also cause "Sweating."

Fifth: The application of varnish that has been exposed to cold weather. Varnish exposed to cold weather becomes "Specky" and "Seedy." The term applied to varnish in this condition is called "Chilling." The remedy for this trouble is to keep the varnish in a warm room until restored to normal condition even should it be necessary to keep it near a steam pipe or a warm stove until the chilled particles have disappeared.

Sixth: The use of one brand of varnish for all purposes. As already pointed out, different parts on a project require different varnishes. It is not possible to embody in one varnish the necessary qualities for every finishing requirement, therefore good results cannot be expected if the varnish used is not designed for the work.

Seventh: Improper thinners. They have a deteriorating effect on the quality of the varnish and the durability of the finish. Even proper thinners wrongly used will also cause trouble, particularly in cold weather. When adding cold thinners to cold varnish, care must be exercised to allow proper time to elapse for assimilation of the materials. Turpentine added to varnish, unless heated, requires about twelve to fifteen hours for proper blending. If used before such time elapses means to spread on the surface myriads of small bubbles formed by the presence of air in mixing, the result being that the varnished surface appears sandy.

Eighth: Temperature. Freshly applied varnish is sensitive to sudden change of weather conditions, such as extremes of heat and cold, insufficient ventilation, drafts and dampness. Proper light and ventilation are absolutely necessary to facilitate drying and hardening. Varnish applied in buildings that are damp and not properly heated in cold weather will be considerably retarded in drying and hardening. Extremely hot weather will keep varnish soft for quite a time. The best results are derived at a temperature of 70 to 75 degrees F.

Ninth: Exposure to dampness, moisture or gases before complete hardening takes place. This causes a condition known as

"Blooming" or "Going Foggy." The condition is, however as a rule, temporary, and ultimately disappears unless ammonia is present in the atmosphere. The change then is one of chemical action and is permanent. The more elastic the varnish the less liable it is to "Bloom" or "Become Foggy."

Tenth: Unseasoned or damp lumber. When dampness is retained in the wood or if moisture exists in the undercoats when the finishing coat is applied the action of heat such as the concentrated rays of the sun will result in "Blistering." "Pitting" is another condition caused by varnish being applied over an oily or damp surface. The action of water or dampness will also cause varnish to turn white.

Eleventh: Knots and sappy woods. Unless knots or sappy spots are killed by the use of grain or wood alcohol shellac before any varnish whatever is applied to the surface, the sap will work through and destroy the finish.

Twelfth: The use of brushes not thoroughly cleaned and not free from all foreign matter. If varnish is applied with brushes in this condition the foreign matter in the brush will work down into the varnish as it is applied to the wood and will have a detrimental effect on the varnish, dependent of course upon the nature of the foreign matter in the brush.

Since varnish is affected by so many conditions any one of which may be responsible for unsatisfactory results and entail additional expense to repair the damage, the question naturally arises how the architect, whose duty to his client makes it necessary for him to see that the varnish used is in keeping with the character of the project and is properly applied, can guard against finishing troubles.

The architect will materially overcome varnish trouble and annoyance by becoming familiar with the various varnishes designed for different uses and specify varnishes not merely by the maker's name, but rather by the maker's name and the brands of his manufacture. It is essential when specifying varnish to know that the proper varnish has been specified for each particular part of the work; that the surface to be varnished is in fit condition to receive it; and to see that the specified brands are supplied and used by the contractor.

From the foregoing it is apparent that the question of architectural varnishes is one requiring the architect's careful consideration and where complaints arise, thorough investigation is necessary to determine the cause. In such cases the architect will facilitate matters by consultation with the manufacturer, who is just as anxious that satisfactory results shall be derived from the use of his products as is the architect to have the work properly finished. In other words, close co-operation on the part of the architect and manufacturer will go a long way to insure better all around finishing results.

We are indebted to a modest friend of the architects for this clear, concise statement of technical problems involved in the manufacture of architectural varnishes, and we feel it cannot fail to be very helpful reading for them. There is no material entering into a building which requires more intelligence in selection and application than varnish. Since architects must select and contractors must apply, both must be well informed as to its nature. The details given herein make the elements of this knowledge easy of attainment by so wording the discussion as to avoid the use of unintelligible technical terms. With such a knowledge of the subject as can be obtained by a study of this article it cannot fail to be apparent that in the last analysis the architect, in the matter of painting at least, is very much dependent on the ability and integrity of the contractor. - Editor

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STANDARD PAINTERS' MATERIALS.

An attempt is made in the following to define those materials which may be readily prepared by any competent painter, that are generally accepted as standard for high grade work. Such materials very properly form the basis of comparison for all proprietary paints. No proprietary preparation should be accepted for use that does not equal in enduring wearing quality, appearance, cost and ground for subsequent coats, the materials hereinafter described.

Classification of preservative and decorative coverings is commonly made according to the nature of the surfaces which these materials are designed to cover.

Materials for painters' work are divided according to their nature under the following headings: Pigments, Binders and Agents or Solvents.

Paint consists of a binder or binders and a pigment or pigments incorporated or mixed together. Mixing of paint ingredients may be accomplished in a satisfactory manner, either by stirring or grinding together by hand or by machinery. Machinery mixing with proper apparatus is most certain to secure uniformity of result, and is therefore advised where practical.

Linseed Oil is the only known universally successful binder for paint and the holding power of the paint depends almost entirely on the strength of the linseed oil used. This oil is adulterated in many ways, but the most common is with mineral oil. The manufacturers of mineral oil substitute have perfected their product to such an extent that it is difficult to distinguish it from the real article except by chemical test or actual use, when its inferiority is quickly manifest.

STANDARD BINDERS.

Raw Linseed Oil is the oil obtained from the seeds of the flax-plant, *linum usitatissimum*, and what is known as commercially pure grade, has a specific gravity of not less than .931, nor in excess of .937, when the temperature is 15½ deg. centigrade. It is a straw yellow in color, weighs approximately 7½ lbs. to the gallon, has a boiling point at 260 deg. Fah. and solidifies at 17 deg. Fah.

Boiled Linseed Oil, commercially pure, consists of raw linseed oil as above defined, kettle boiled at a temperature not to exceed 500 deg. Fah. nor less than 300 deg. Fah.; or the same sort of oil prepared with best pure Japan dryers, so as to increase drying qualities. If salts of lead or manganese are thoroughly incorporated into the raw oil, very similar results are produced to the boiling process. An old method of increasing the drying properties of linseed oil was to heat the oil to near the temperature at which it undergoes destructive distillation (550 deg. Fah. or thereabouts), and stir in at the same time, oxide of lead or oxide of manganese, or both. Such method, however, darkens the oil very much.

Spirits of Turpentine, chemically pure, is composed of a volatile oil obtained by the distillation of turpentine oil obtained by tapping or boxing yellow pine trees. It is a clear, colorless liquid, with a pleasant pungent odor and shows a very slight residue when evaporated. Spread over any surface in a thin layer, it will dry in twenty-

four hours, leaving hard dry varnish. Turpentine weighs about 7 lbs. to the gallon of bulk.

STANDARD PIGMENTS.

Red Lead, practically pure from a commercial standpoint, is equal to 98 per cent lead tetroxide; but to secure this degree of purity, without a trace of soda or nitrate salts, requires a special method of reduction not employed by all manufacturers. In fact it has only been within the last few years that even the best manufacturers have been able to produce a pure red lead without having present from .1 to .5 per cent of soda or nitrate salts, which salts have a strong tendency to promote rust. Paint is intended as a protection of metal against rust, and as such should not contain any elements of a rust inducing nature. Specification should therefore require that red lead must be wholly free from soda or nitrate salts. The process now used to get red lead which is 98 per cent true, is by burning the lower grade red lead, 85 per cent true, for about 20 to 24 hours longer. This brings the true red lead, Pb_3O_4 up to the high standard which has lately been accepted as most effective in prohibiting rust. The American Society for Testing materials after exhaustive tests conducted within the last nine years have concluded that the highest grade red lead, 98 per cent true, is even more lasting in character than the red lead which was formerly considered best for paint pigment which was about 83 per cent true red lead Pb_3O_4 (tetroxide of lead) plus 17 litharge PbO (monoxide of lead). The Government specifications have been raised from 85 per cent to 90 per cent true, and lately have been increased to 95 per cent of true red lead.

This, therefore, argues very strongly for the 98 per cent true red lead, but it still remains a fact that very enduring paint can be made in compliance with the following formula: Pb_3O_4 (tetroxide of lead), 82.88 per cent plus litharge PbO (monoxide of lead) 17.12 per cent. Owing to the tendency of this combination of red lead and litharge pigment to unite with linseed oil in chemical combination, paint composed of red lead and linseed oil should not be prepared to exceed twenty-four hours before using. For if this combination of red lead and litharge is mixed with linseed oil and sealed up in an air-tight can, it will be found after a time that the mixture has solidified showing that the oxygen of the air which is the hardening agent in ordinary paints is not necessary. The chemical combination that thus takes place between the litharge and the oil in this mixture probably gives an increased toughness and endurance to paint applied according to this formula provided this chemical action takes place after the paint is applied. Practically, it is very difficult to secure intelligence in the application of paint to structural portions of a building and it is therefore doubtful practice to use so large a percentage of litharge, not because it will not make a strong enduring paint, but because it is extremely difficult to get same applied before chemical action takes place. It has been found also that the addition of say 10 per cent of a practically inert pigment such as Princess mineral or oxide of zinc, increases the wearing quality of red lead paint without other injurious effect.

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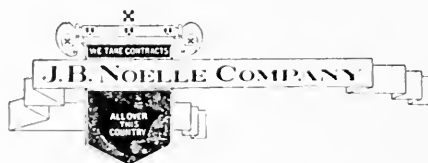
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Corroded Lead, Basic Lead Carbonate = chemically to $PbCO_3 \cdot Pb(OH)_2$ is the form of lead pigment which has been in most general use for many years past. A satisfactory formula for white lead pigment is 70 per cent to 75 per cent of lead carbonate to 25 to 30 per cent of lead hydrate; this is in substantial compliance with U. S. Government standard specifications. While Basic Lead Carbonate is more poisonous than sublimed lead it still is a perfectly safe pigment to use with proper precautions. In fact nearly all paint pigments are more or less poisonous and so care should be taken by painter to avoid allowing paint to come in contact with the skin.

Sublimed Lead or Basic Lead Sulphate = chemically to $PbSO_4 \cdot PbO$ is coming into general use for paints and is practically non-poisonous and is just as valuable as a pigment for many purposes as the older form. It is particularly satisfactory as a base for tinting colors.

White Lead Paste averages to contain by weight 92% dry lead pigment and 8% linseed oil and weighs about 38.1206 lbs. to the gallon of bulk.

Zinc White is oxide of zinc made by burning zinc in air. It is whiter than white lead but is not so opaque, and more coats of zinc paint are necessary to get a given effect over a dark background than of white lead. Paint consisting of commercially pure zinc white and linseed oil makes a strong and enduring wearing surface but does not produce as satisfactory ground for repainting after a period of service, as paint composed of a white lead pigment and linseed oil.

Graphite, or plumbago, may be said to be diamond plus heat; for if a diamond is heated to a very high temperature, without access to the air, it swells up and is converted into a black mass exactly resembling graphite in every particular. This theory being further verified by the fact that this change takes place without the loss or increase of weight. Graphite is found in nature in large quantities. It is sometimes found crystallized, but in a form different from diamond. Graphite can be prepared artificially by dissolving charcoal in molten iron; from such a solution graphite is deposited on cooling. Pure graphite is dark grayish-black in color and of a metallic luster. It is quite soft, leaving a leaden-gray mark on paper when drawn across same. It is used in the manufacture of the so-called lead pencil and is sometimes called black-lead. Such designation is wholly misleading, as it is in no sense metallic lead. Graphite is pure carbon, the element which is the principal constituent of all organic matter, both vegetable and animal. It is extensively used as a paint pigment, particularly for metal coating. Finely ground amorphous or non-crystallized graphite, when mixed with linseed oil, forms perfectly an inert pigment, united in mechanical mixture with the oil, and without the slightest evidence of chemical combination. For this reason prepared graphite-paint is not injured by age as is the case with oil-paints, which are composed of oil and a pigment which will form a more or less stable chemical union with same. It is contended, by advocates of Graphite paint, that the inert nature of graphite pigment contributes to the ease of its application and adds to its covering capacity and elasticity, making a better appearing mechanical job with less labor and also a covering which can accommodate itself to the contraction and expansion of the material covered without serious injury to its efficacy as a protective covering. The non-active nature of graphite pigment makes it possible to coat surfaces with a much thinner coating than with a paint containing a pigment which acts chemically with its oil.

Lamp Black is a very finely divided form of charcoal produced by the deposit on cold surfaces of the imperfectly combusted products from burning oil. Lamp black may be said to be the soot produced by burning oil without sufficient oxygen present to form perfect combustion. This soot is largely made up of fine particles of carbon. Lamp black is used in the manufacture of ink and as a pigment for paint to be applied to metal. Many of the best contracting painters insist that lamp black ground and mixed with linseed oil forms the most enduring and attractive appearing paint for ornamental iron.

Colors are produced by mixing the various color pigments with the standard base pigments of lead or zinc. Some of those color pigments contribute slightly to the endurance of the paint but generally speaking most color pigments do not add to the protective and enduring value of paint. The volume of base pigment needs to be reduced in proportion to the amount of color pigment added, so as to maintain the same relative relation of pigment to oil in the various coats as hereinafter prescribed. The scope of this article does not permit a discussion of the composition and merits of the numerous commercial color-pigments offered to the trade.

Chemical action between the pigments and oil in paint ordinarily does not occur, but there are exceptions. Sabin states that such action takes place with White Lead and Linseed Oil, "probably between the oil and the lead hydrate, which constitutes at least a quarter of the pigment." "This change is said to be due to resinification of the oil converting into a sort of varnish." "Zinc Oxide (White Zinc) also acts on oil, but in a much less degree." "Paint consisting of White Lead and White Zinc mixed together in the proportions of two of lead to one of zinc is reputed to be superior to either alone. Zinc brushes more readily, but will cover less surface than White Lead."

PAINT.

Primer of Lead and Oil for new work should be proportioned by bulk, so as to contain 27% of White Lead Paste, 62% of Linseed Oil and 11% of Turpentine.

Priming Lead and Oil will require 10.3 lbs. White Lead, .62 gal. Linseed Oil and .11 gal. Turpentine to make one gal. of paint.

One Gallon Lead and Oil Primer will average to properly cover about 2 3/4 squares of new wood work or 1 1/4 squares of common brick work.

One Square of New Wood Work requires to properly prime same with lead and oil 3 3/4 lbs. White Lead, .23 gal. Linseed Oil and .04 gal. Turpentine, or if common brick requires 8.24 lbs. White Lead, .5 gal. Linseed Oil and .058 gal. Turpentine.

Succeeding Coats of Lead and Oil Paint after primer should be proportioned by bulk so as to contain 30% White Lead, 64% Linseed Oil and 6% of Turpentine.

Succeeding Coats of Lead and Oil Paint after priming will require 11.44 lbs. White Lead Paste, .64 gal. Linseed Oil and .06 gal. of Turpentine to the gal.

One Gallon Lead and Oil Succeeding Coater will average to properly cover, any coat, about 4 1/2 squares of wood work after same has been primed, or 3 squares of common brick work, second coat. Third coat on brick work, one gal. will cover as much surface as on wood.

One Square of Any Oil Succeeding Coat on wood work after same has been primed will average to require to properly cover same, 2.54 lbs. White Lead, .14 gal. Linseed Oil and .0133 gal. of Turpentine; or for 2nd coat on common brick work, 3.48 lbs. White Lead, .21



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gal. Linseed Oil and .02 gal. of Turpentine. (Third coat on brick work will require the same amount of paint to unit of surface as "Succeeding Coats" on wood.

Paint for metal, first coat, should not be applied until after the surface is thoroughly cleaned free from dirt or grease, as such material keeps the coating from coming in contact with the metal, so that it cannot adhere to same. It might be supposed that grease would be absorbed by paint or varnish but this does not prove true in practice. To mix such materials would require their thorough agitation together. This is prevented in the application over dirty surfaces due to the fact that the grease is always mixed with and covered by an adherent film of dirt, which interferes with the action of the paint or varnish upon it; consequently making a loose film which will not permanently support the paint coating.

Primer for metal of red lead to give satisfactory results can be made by mixing 23 lbs. of dry "red lead for painting metal" to 1 lb. of "zinc white," adding sufficient commercially pure "raw linseed oil" to make a gallon of the mixture, and thoroughly incorporating together. The mixing of the oil and pigment should only be as required at the work, never to exceed 24 hours before applying. The paint resulting will be rather stiff and requires thorough and careful brush work to make the surface elastic, and the material cover proper area. This paint should not be thinned by addition of evapotent liquids, as these have a tendency to produce destructive chemical action on the paint, effecting its permanency as a protective coating.

Succeeding coats on metal, after primer, can very satisfactorily be of white lead and oil or zinc paints as above described, or a combination of the two.

Primer for masonry surface which has a strong alkaline reaction, such as plastered walls, brick masonry and concrete, should consist of a solution of zinc sulphate crystals dissolved in water, in the proportion of 3 lbs. to the gallon, after which succeeding coats of paint as defined above for wood work may be applied with satisfactory results. Oil paint should never be applied direct to masonry. There are a number of proprietary mixtures that are prepared especially for this purpose and which give excellent results.

Paste Filler for open grained hard-wood finish or floors requires for proper filling and wiping 1½ lbs. Silux paste and .14 gal. thinner to the square.

Wiping of paste filler is done with burlap, sea moss or excelsior and should always be done across the grain of the wood as if rubbed with the grain of the wood there is a tendency to lift the filler out of the pores of the wood and waste same, requiring more filler to give satisfactory results.

Thinner for paste filler may be either Turpentine or Benzine if the filler is of best quality of rock quartz, water floated, very finely bolted and mixed with special Japans and Linseed Oil, Benzine seems to give the most satisfactory results for a thinner owing to its quicker evaporation. For the cheaper fillers Turpentine must be used.

Paste Filler is tinted or left transparent according to the color effect desired.

Stains for wood work usually form one coat in addition to filler and coats of varnish or wax; these are of three kinds, oil-stain, spirit-stain and water-stain, and are used according to the effect desired.

Oil-Stain averages to require about .15 gal. to the square.

Spirit-Stain averages to require about 1½ gal. to the square.

Water-Stain averages to require about .2 gal. to the square.

Prepared Wax averages to require about .33 lbs. to the square.

Gloss Oil is a term used to designate a preparation composed of resin and naphtha. This is a very cheap substitute for varnish often used as a size for plastered walls preparatory to tinting. It is a very inferior material and when used as a size softens and roughs with repeated washings. It is ruinous when used as a varnish or as a binder for paint.

Varnish, Best Light Interior, requires for properly coating one square, 1st coat over filler, 1-5 to 1-7 gal.

Varnish, Cheap, Thick Rosin, requires for coating one square one gloss coat, ¼ to 1-5 gal.

Creosote Stain required to dip ¾ length one M. shingles equals about 2¾ gal.

Creosote Stain required to brush coat one square shingles equals one gal.

Oil Paint to cover one square metal work, one coat requires about 1-10 gal.

Size for plastered walls preparatory to tinting should be varied according to the nature of the treatment to be applied over same and also with reference to the surface on which it is applied. A very good size for this purpose on smooth plastered walls is a coat of medium grade varnish, such a size would cost about \$1.50 per gallon. A standard medium cost size for smooth plastered walls is made up of China wood oil, resin and naphtha; such a size could be made up for about 75c per gallon. The cheap size commonly used is made up of gloss-oil at a cost of not to exceed 35c per gallon; but, taking into consideration lasting quality and labor expended, this is most expensive and unsatisfactory.

Fresco Size satisfactory for use on rough plastered walls may be made up as follows: Dissolve each separately in the proportions of one pound of glue to one gallon of water, one pound common yellow laundry soap to one gallon of water and one-fourth pound of alum to one gallon of water; the glue and soap solutions then being mixed together first, and after thoroughly mixed, the alum solution added and the whole well stirred together ready for application to the wall.

ESTIMATES ON PAINTING.

PAINTER'S ESTIMATE=(units of surface to be covered) × (amount of material required to cover a unit) × (cost of a unit of material) + [(number of hours of labor required by a mechanic to apply the material to a single unit of surface) × (hourly wage of mechanic) × (number of units of surface)] + (overhead charges, including scaffolding, brushes, drop-cloths, cartage, office expense and expense of supervision, etc.) + (Contractor's profit, which varies with the supply and demand).

UNITS OF SURFACE USED ARE (one sq. ft.), (sq. yd.=9 sq. ft.) or (square=109 sq. ft.).

AMOUNT OF SURFACE UNITS assumed for estimating purposes are increased at the judgment of the estimator. This is done to make proper allowance for increased labor and waste of material on account of broken and complicated surfaces, and so that prices per unit of labor and material can be maintained constant, the following enumerations being the assumptions most commonly used by estimators:

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Sash for exterior are measured over the entire area instead of around each bar.

Shingle Gable, $1\frac{1}{2} \times$ actual surface area.

Dormer Windows $2 \times$ actual surface area.

Shingles, Rough, $1\frac{1}{2}$ to $2 \times$ actual surface area.

Shingles, Dressed, Dimension, actual surface measure.

Spindle work, measure 4 times solid on one side.

Square Spindle work and pickets, $4 \times$ one side measured solid.

Verandas with heavy columns and railings, etc., measure surface of ceiling and floors and all sides the same as though enclosed veranda. Very simple in design, measure floor and ceiling and allow double area of brackets and columns.

Outside Blinds, measure $3 \times$ actual surface of one side.

INTERIOR.

Base Boards, measure not less than 1 foot in width regardless of actual width.

Picture Mouldings, measure 1-3 foot in width.

Single Doors, including trim, count as 35 sq. ft. to a side or 70 sq. ft. for both sides.

Interior Side of Windows, including trim and tracing of sash, average at 35 sq. ft.

Wall Decorations, measure ceiling solid and sidewalls 8-10 of actual area to allow for openings, or measure actual area and deduct $\frac{1}{2}$ to $\frac{3}{4}$ of all openings.

Badly Weathered wood work or cracked and damaged plaster, add from 1-10 to 3-10 to measurements determined as above.

Prices of standard materials are quoted in market reports and fluctuate with supply and demand. The estimator should verify these preceding each estimate. At time of going to press the following prices obtain:

White Lead Paste, 7c per lb.

Linseed Oil, raw, 61c per gal.

Turpentine, 47c per gal.

Paste Filler, about 10c per lb. in 100-lb. packages or $8\frac{1}{2}$ c in bbls.

Interior Varnishes, about \$1.87 to \$2.00 per gal.

Stains vary so much in price that they can not be listed.

First Class Exterior Varnishes, about \$3.50 per gal. (It should be explained that owing to the slow drying or hardening qualities of best exterior varnishes, a cheaper and less durable grade is usually used, costing about \$2.50 per gal.)

Proprietary Oil Paints of best quality are sold to the painters at about \$1.65 to \$1.75 per gal., depending on color. The materials in a gal. of White Lead and Linseed Oil "Succeeding Coat" of paint costs exclusive of labor and coloring matter about \$1.70 at present market prices and the labor of mixing by hand and the expense for colors brings this hand-mixed paint up in price to about the same as proprietary paints of equal quality. Unless the ingredients composing paint are thoroughly incorporated the paint is not satisfactory. This proper mixing, if done by hand, requires considerable expensive labor.

LABOR REQUIRED.

COST OF LABOR=(number of hours of labor required by a mechanic to apply the material to the single unit of surface) \times (hourly wage of mechanics) \times (number of units of surface).

Wage per Hour=union scale obtaining in the locality where the work is to be executed. (In Chicago, this is 70c per hour under an agreement expiring April 1st, 1914.)

Stopping knots with shellac requires in

labor .2 of an hour's time to the square of surface.

Puttying defects in ordinary wood work requires in labor .3 of an hour's time to the square of surface.

Oil painting, single coat, requires in labor .57 of an hour's time to the square of surface.

Paste Filler Coat, including cleaning of wood work, requires in labor 1.33 hours' time to the square of surface.

Varnish, single coat, including light sandpapering, requires in labor .66 of an hour's time to the square of surface.

Creosote staining of shingles by $\frac{3}{4}$ dipping, requires in labor 1 hour of a mechanic's time to dip 1,000 shingles, which average to cover when laid, one square of roof surface.

Creosote staining, one brush coat on roof, requires in labor .8 hour's time to cover one square of surface.

Sizing of plaster walls with either glue or hard oil size requires in labor .33 of an hour's time to the square of surface.

Tinting with water color, fresco tints or calcimine averages to require in labor .44 hour's time to the square of surface to the man employed, providing not less than two men are employed on the work. (Ordinarily, one man cannot work alone at tinting of walls, for if he does so work, the work cannot be satisfactorily done and more time is required in proportion to the surface covered.)

Sponging and washing walls requires in labor a variable amount of time to the square according to the amount of size used in coat to be removed and must be approximated by the estimator after examination and test.

ILLUSTRATIVE CHARGES FOR CONTRACT WORK.

The following items illustrate some of the average charges made by contractors for material and labor at the time of going to press:

Whitewashing (machine applied) including material, labor and contractor's profit, about 20c per square, varying according to the size of the job, sometimes, in case of very large jobs, being figured as low as 15c.

Whitewashing (hand brush applied), including material and labor and contractor's profit, about 35c per square.

Painting, two coat work, is estimated as worth \$2.35 per square; itemized, 52c for all material and \$1.83 for labor and profit.

Varnish work, including one coat of paste filler and two coats of varnish, is worth about \$2.60 per square.

Sizing walls is worth about 45c per square for hard oil size.

Tinting walls, depending on color, averages to be worth 45c per square.

FIXED CHARGES.

The expenses of conducting the painting contracting business vary according to the efficiency of organization and range from 25 to 35 per cent of the cost of executing the work.

THE ESTIMATE.

After surfaces are priced, as described above, and items totalled, about 30 per cent should be added to cover fixed charges and a percentage for profit, varying according to the reputation of the contractor, which will give the probable contract price of the work.

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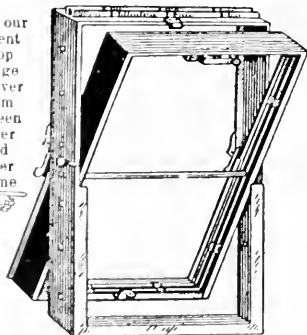
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GLASS AND GLAZING

The following data is given to satisfy the need of architects and draftsmen for definite information regarding conditions of manufacture, qualities and sizes of glass which are essential to accurate, practical specification and detail.

WINDOW GLASS is blown glass in distinction from plate or rolled glass. This glass being blown out in cylinders, either by hand or machinery, and the glass cylinders cut and straightened out. Such glass is likely to show a slight bulge and is frequently broken in setting or after setting, on account of the difference in tension between the two surfaces of the glass produced by straightening out or developing the cylinders of glass and not from any fault of the glazier.

Machine-Made "Double Strength" measures about nine lights to the inch in thickness. By far the major portion of all sheet glass on the market is machine made. It is not unusual to find large glazing houses with almost no hand-made glass in stock.

Hand-Made "Double Strength" sheet glass measures about eight lights to the inch in thickness. Inasmuch as it takes about fifteen men to blow and make the same amount of glass as one man with a machine, the purchaser must expect to pay more for hand-made than for machine-made glass, but hand-made glass of the same grade will show far less defects and is of greater strength.

"AA" Grade Sheet Glass is especially selected glass designed for picture use and is not manufactured in sufficient quantities to supply the demand of the market for Sheet Window Glass, so that where this glass is specified, the glazier usually substitutes "A" grade.

"A" Grade Sheet Glass is the standard quality of Sheet Window Glass used for the glazing of windows in the general run of buildings and is the best quality on the market in sufficient quantities to meet the demands for sheet glass window glazing.

"B" Grade Sheet Glass is an inferior grade, full of air bubbles and other defects, suitable only for cheap factory, greenhouses and similar work.

PLATE GLASS is poured and rolled, after which it is polished down on each side to the desired thickness. As it is almost impossible to gauge a polishing machine so that it will polish each end of the sheet the same thickness, plate glass, therefore, varies in thickness from $\frac{3}{16}$ " to $\frac{3}{8}$ ", usually from $\frac{1}{4}$ " to $\frac{5}{16}$ ".

CAST OR ROLLED GLASS: This is really not a plate glass but it is a sheet glass and is cast on a table and then rolled, and in order to get the desired thickness what is known as trangs are used on the side of the table to govern the thickness of the glass.

"Rough" Glass gets its name from the rough surface of the table on which the glass is poured and then rolled, the lower

surface being rough and the upper surface, which is the natural surface, being glossy.

"WIRE GLASS" is rolled glass wherein the wire mesh is mechanically set at equal distance from each surface during the course of manufacture.

"Rough Wire" Glass is wire plate glass just as it comes from the rollers, without polishing.

ROUGH, RIBBED, MAZE, ROMANESQUE and SYENITE "WIRE GLASS" determine the style of surface which comes from the use of different figured tables.

POLISHED "WIRE GLASS" is made in the same way as Rough, Ribbed or Maze "Wire Glass" but is rolled in a rough sheet of sufficient thickness to polish down either side after the glass has been properly annealed. Quite frequently the mistake of specifying Polished Plate Wire Glass is made, whereas, Polished "Wire Glass" is not supposed to be a plate glass as it is taken from a tank furnace by a ladle which does not produce a product as free from bubbles as pouring the glass from a pot furnace as they do in making Polished Plate glass, therefore, specifications should call for Polished "Wire Glass".

RIBBED "WIRE GLASS" is rolled glass with the corrugated or grooved surface on the table side, thus allowing the smooth side of the glass to be glossy.

MAZE "WIRE GLASS" which, by the way, is highly recommended on account of its light diffusive powers is a figured rolled glass and the figure is produced on the table side of the glass, thus leaving the upper surface glossy.

ORNAMENTAL GLASS, which is more commonly known as figured glass, includes the following designs which are most popular: Romanesque, Apex, Pentecor, Maze, Syenite, Florentine, Ondoyant, together with other styles which are known according to the manufacturer's number, such as No. 1, No. 2, No. 3, etc. This style of glass is all rolled, some of the figures being produced on the table surface of the glass, thus leaving the upper surface glossy, while others are produced from a roller which necessitates the figure being on the upper surface and the lower surface of the glass which is flat has a dull appearance. The first mentioned process is by far the best.

"Chipped" Glass may either be chipped plate or chipped sheet glass, as chipping is accomplished by treating the surface of the glass with hot oil and then peeling off same, thus chipping the surface. Double chipping is accomplished by repeating the process, so that the architect when he specifies "chipped" glass should be particular to say whether he wishes sheet or plate, single or double chipped.

"Ground" Glass is produced by grinding the surface of any sort of glass with a sand blast process, so that the architect should

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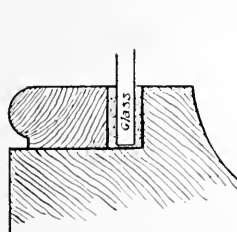
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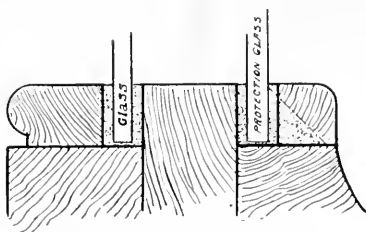
specify whether he wants plate or sheet glass when he specified ground glass.

We give below details approved and recommended by the National Ornamental Glass Manufacturers' Association of the United States and Canada as the minimum size of rabbets, jams and sills for art glass glaz-

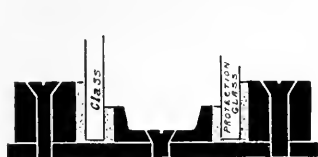
ing; also details for metal sash and ventilator construction. Rabbets for ordinary window glass glazing should never be less than $\frac{1}{4}$ of an inch in depth but should always be made at least $\frac{3}{8}$ of an inch where this is practical from the standpoint of design.



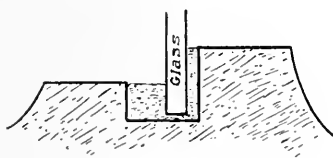
$\frac{1}{2}$ size—Single Glazing



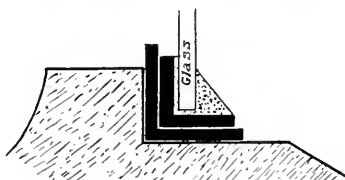
$\frac{1}{2}$ Size—Double Glazing
Some Details for Stone Omitting Loose Strips



$\frac{1}{2}$ Size—Metal Division Bars and for framing



$\frac{1}{2}$ Size—Stone Detail for Heads and Jambs



$\frac{1}{2}$ Size—For Sills and Showing Ventilator Setting

COLORED GLASS is produced by introducing various substances into the molten glass and by complicated processes of manufacture, the more expensive glass coming in sheets of irregular shape and thickness, the price varying according to the value of the coloring matter introduced. The precious metals such as gold and silver, are required for the production of certain colors which necessarily makes these expensive. On account of the big variation in price of the different coloring matter used in the manufacture of opalescent glass, this glass varies in cost according to color.

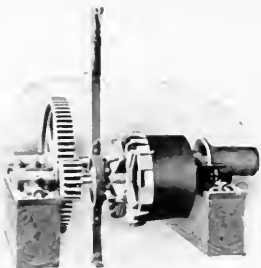
"Cathedral" Glass measures eight sheets to the inch and is practically uniform in color, this being practically the cheapest colored glass on the market.

"Opal Cathedral" Glass measures about eight sheets in thickness to the inch and is practically uniform in thickness, but showing in a measure the variation in color of opalescent or opal glass.

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Opalescent Glass varies in thickness from $\frac{1}{16}$ " to $\frac{3}{4}$ " and also varies in color almost without limit. It is practically impossible to get exactly the same shade in two successive meltings of opalescent glass; in fact, many of the most beautiful sheets of opalescent glass have been mere accidents of manufacture. Where the art glass cutter and glazier is unable to secure the peculiar shade of color required in cartoon by cutting from any one sheet of glass in his stock he accomplishes this result by plating several sheets over each other, thus by a combination of the colors in the different sheets producing the shade desired.



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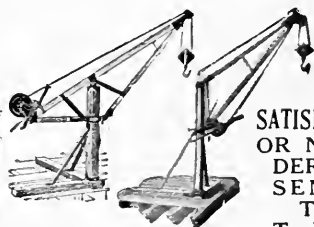
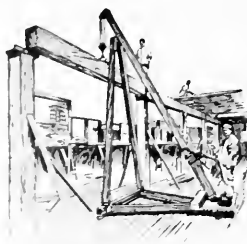
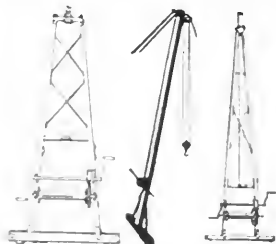
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ARCHITECTURAL ACOUSTICS

Contributed by Laurence C. Hart, S.E., Acoustical Engineer.

Due to the lack of sufficient data and the inadequate study of the problems involved, until recent years, the subject of architectural acoustics has continued to remain shrouded in wholly unnecessary mystery. The conditions surrounding the transmission of speech in an enclosed auditorium are complicated, it is true, but are such as will yield an exact solution in the light of adequate data. It is not unreasonable, therefore, to include the problems of architectural acoustics among the rational engineering problems.

Even though the problem of acoustics is complex, and though each particular auditorium offers numerous and various difficulties, it is entirely possible to affect a cure and arrive at a very accurate solution. It must be admitted, nevertheless, that auditoriums of varying size and design, lend themselves to correction in varying degrees, depending on the circumstances. In certain rooms a correction may be affected which will give absolutely perfect acoustical quality, while in others, only a partial correction may be obtained, due to insurmountable difficulties.

There are several important conditions and factors of this problem. In order that hearing may be good in any auditorium it is necessary that the sound should be sufficiently loud, that the simultaneous components of a complex sound should maintain their relative intensities, and that the successive sounds in rapidly moving articulation, either of speech or of music, should be clear and distinct, free from each other and from extraneous disturbances. These three are the necessary as well as the entirely sufficient, conditions of good hearing. Scientifically, the problem involves the following three important factors: (1) **Reverberation**; (2) **Interference**; (3) **Resonance**. From the standpoint of an engineering problem the following factors are involved: (1) The shape of the auditorium; (2) the size and dimensions; (3) the materials composing the interior finish.

Since sound is one form of energy, once it is produced in an enclosed space, it will continue to be audible until its energy is finally dissipated, either by transmission through the confining walls or by absorption by the materials in the room. In the latter case the sound energy is transformed into some other form, usually heat. This process is called **sound decay** or the **absorption of residual sound**. As a concrete example, the experiments of Professor Wallace C. Sabine of Harvard University may be cited. In one lecture hall at the University the rate of absorption was so small that a word spoken in an ordinary tone of voice was audible for five and a half seconds afterwards. In this period a very deliberate speaker would have uttered twelve or fifteen succeeding syllables. The successive enunciations in this hall blended into a loud, confusing sound, making it impossible to distinguish the individual syllables above the confusion and therefore, the understanding of speech was very imperfect and difficult.

This phenomenon may be regarded as a process of **multiple reflection** from walls, ceiling and floor, first from one and then from another, losing some little sound energy at each reflection until the whole amount is finally dissipated and the sound inaudible. The phenomenon of multiple reflection is technically termed **reverberation** and the period of sound endurance is more rapidly decreased by the introduction of an audience because of the high absorbing power of clothing. One special case of reverberation is **echo**. In general, reverberation results in the reflected sounds piling up and eventually filling the room with a mass of confused

sound, incapable of analysis into distinct reflections. Echo, on the other hand, results from the reflection of sound from a single surface or several surfaces striking the ear of the auditor with a short, sharp snap, producing an exact repetition of syllables or words. This repetition may occur only once or many times, depending on the nature of the reflecting surface and on the position of the auditor with respect to the surface or surfaces.

In the general case of **reverberation**, we are concerned only with the rate of decay of the sound. In the special case of **echo**, we are concerned not merely with its intensity, but with the interval of time elapsing between the initial sound and the moment it reaches the ear of the auditor.

After due consideration of all the methods of measuring the intensity of sound, including several optical devices, Professor Sabine abandoned all established methods and decided to follow an entirely new procedure in conducting his experiments on the acoustics of auditoriums. Instead of measuring directly the rate of decay of sound within a confined space, he decided to measure that which was inversely proportional to it, the duration of audibility of the reverberation, or in other words, the duration of audibility of the residual sound.

In general, there are only two variables affecting acoustics in an auditorium, shape of the room and material used in its interior finish. The former includes the size and the latter includes the furnishings and the clothing of the audience. In designing an auditorium, an architect can give consideration to both in correcting or improving the acoustics of an auditorium already built, it is impractical to change the shape or size and therefore, only variations in the materials and furnishings are allowable.

In one of his reports Professor Sabine describes his experiments in the lecture hall at Harvard University mentioned above, as follows:

It was evident, that other things being equal, the rate at which the reverberation would disappear was proportional to the rate at which the sound was absorbed. The first work, therefore, was to determine the relative absorbing power of various substances. With an organ pipe as a constant source of sound, and a suitable chronograph for recording, the duration of audibility of sound after the source had ceased in this room when empty was found to be 5.42 seconds. All the cushions from the seats in Sanders Theatre, Boston, Mass., were then brought over and stored in the lobby. On bringing into the lecture room a number of cushions, having a total length of 8.2 meters, the duration of audibility fell to 5.33 seconds. On bringing in cushions of a total length of 17 meters the sound in the room after the organ-pipe ceased was audible for but 1.91 seconds. Evidently the cushions were strong absorbers and rapidly improving the room, at least to the extent of diminishing the reverberation. The result was interesting and the process was continued. Little by little more cushions were brought into the room, and each time the duration of audibility was measured. When all the seats, 436 in number, were covered, the sound was audible for 2.03 seconds. Finally when all the cushions from a theatre seating nearly 1,500 persons were placed in the room, covering the seats, the aisles, the platform, and the rear wall to the ceiling, the duration of audibility of the residual sound was 1.11 seconds. This experiment, requiring, of course, several nights work, having been completed, all the cushions were removed and the room was in readiness



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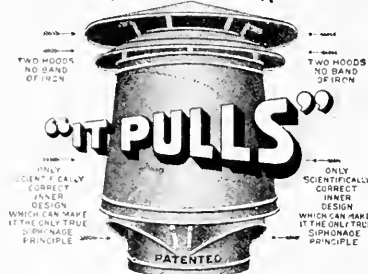
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established. Curtains of chenille, 1.1 meters wide and 17 meters in total length, were draped in the room. The duration of audibility was then 4.51 seconds. Turning to the data that had just been collected, it appeared that this amount of chenille was equivalent to 30 meters of cushions from Sanders Theatre. Oriental rugs (Herez, Demirjick and Hindoostanee) were tested in a similar manner, as were also cretonne cloth, canvas and hairfelt. Similar experiments, but in a smaller room, determined the absorbing power of a man and of a woman, always by determining the number of running meters of Sanders Theatre cushions that would produce the same effect. This process of comparing two absorbers by actually substituting one for the other, is laborious, and it is given here only to show the first steps in the development of a method. Without going into details it is sufficient here to say that this method was so perfected as to give not merely relative, but absolute, coefficients of absorption. In this manner a number of coefficients of absorption were determined for objects which could be brought into and removed from the room, for sounds having a pitch an octave above middle C. When the objects are not extended surfaces such as carpets or rugs, but essentially special units, it is not easy to express the absorption as an absolute coefficient. For such cases the absorption had to be determined in terms of one square meter of complete or 100 per cent absorption such as open window space.

Of even greater importance was the determination of the coefficient of absorption of floors, ceilings and wall surfaces. The accomplishment of this called for a very considerable extension of the method adopted. If the reverberation in a room as changed by addition of absorbing material are plotted, the resulting curve will be found to be a portion of a hyperbola with displaced axes. If the origin of the curve is displaced so that the axes of coordinates are the asymptotes of the rectangular hyperbola, the displacement of the origin measures the initial absorbing power of the room, its floors, walls and ceilings. Such experiments were carried out in a large number of rooms in which the different component materials entered in very different degrees, and an elimination between these different experiments gave the coefficients of absorption in terms of absolute units or in terms of open window space, using one square meter or one square foot of open window space as unity.

If the experiments in these rooms are plotted in a single diagram, the result is a family of hyperbolas showing a very interesting relationship to the volumes of the rooms. Indeed, if from these hyperbolas, the parameter, which equals the product of the coordinates, is determined, it will be found to be linearly proportional to the volume of the room. This proportionality holds good over a very great range in volume. We have thus at hand a ready method of calculating the reverberation for any room, its volume and the materials of which it is composed being known. The first five years of the investigation were devoted to violin C, the C an octave above middle C, having a vibration frequency of 512 vibrations per second. This pitch was chosen because, in the art of telephony, it was regarded at that time as the characteristic pitch determining the conditions of articulate speech. The planning of Symphony Hall, Boston, Mass., forced an extension of this investigation to notes over the whole range of the musical scale, three octaves below and three octaves above violin C.

In the very nature of the problem, the most important datum is the absorption-coefficient of an audience, and the determination of this was the first task undertaken. By means of a lecture on one of the recent developments of physics, wireless telegraphy

an audience was thus drawn together and at the end of the lecture requested to remain for the experiment. A threatening thunderstorm made the audience a small one and the sultriness of the atmosphere made the opening of window necessary, so that the experiment was not a success. Another, the following summer, however, was more successful. By performing the experiment over the entire scale it was found that the coefficient of absorption per person, expressed in terms of 1 sq. meter of complete absorption varies as follows: C_1 -.15— C_2 -.33— C_3 -.41— C_4 -.45— C_5 -.46— C_6 -.47— C_7 -.17; from these figures, it may be seen that the coefficient has a very slight variation indeed, from C_3 to C_7 . In the American system this reduces to a coefficient of absorption equivalent to approximately 4.7 square feet of complete absorption per person.

By similar experiments Professor Sabine developed the coefficients of absorption for wood sheathing, plaster on various kinds of masonry and lath, marble, sheet metal, cement, glass, hard wood, cork carpet, linoleum, carpet, draperies, cushions, hair felts of different thickness and all materials used in finishing and furnishing auditorium interiors.

In both articulate speech and music the source of sound is rapidly changing in pitch, quality and intensity. In music one pitch is held during the length of a note. In articulate speech, the unit is the syllable. During the continuity of an element or unit, a train of sound waves spreads spherically from the source just as a train of circular waves spreads outward from a boat on the surface of still water. Different portions of this train of spherical waves strike different surfaces of the auditorium and are reflected. After such reflection they begin to cross each other's paths. If their paths are so different in length that one train of waves has entirely passed before the other arrives at a particular point, the only phenomenon at that point is prolongation of the sound. If the space between the two trains of waves is sufficiently great, the effect will be that of an echo. If there are a number of such trains of waves thus widely spaced, the effect will be that of multiple echoes. On the other hand, if two trains of waves have traveled so nearly equal paths that they overlap, they will, dependent on the difference in length of the paths which they have traveled, either reinforce or mutually destroy each other. Just as two equal trains of water-waves crossing each other may entirely neutralize each other if the crest of one and the trough of the other arrive together, so two sounds, coming from the same source, in crossing each other may produce silence. This phenomenon is called **interference**. This has its complement. If the two trains of water-waves so cross that the crest of one coincides with the crest of the other, or trough with trough, the effects will be added together. If the two sound-waves are similarly retarded, the one on the other, their effects also will be added. If the two trains of waves are equal in intensity, the combined will be quadruple that of either of the trains separately or zero, depending on their relative retardation. The effect of this phenomenon is to produce regions in an auditorium of **loudness** and regions of comparative or even complete **silence**. This accounts partially for so-called **deaf-regions** in an auditorium.

While these several factors, **reverberation**, **interference** and **echo**, in an auditorium at all complicated are themselves complicated, nevertheless they are capable of an exact solution, or, at least, of a solution as accurate as are the architect's plans in actual construction; and it is entirely possible to calculate in advance of construction whether or not an auditorium will be good, and, if not, to determine the factors contributing to its poor acoustics and a method for its correction.

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STANDARD RULES OF THE MEASUREMENT OF PLASTERING.

Adopted by the Employing Plasterers' Association of Chicago.

LATH AND PLASTERING

to be measured by the superficial yard, from floor to ceiling for walls, and from wall to wall for ceilings.

In rooms containing one or more horizontal angles between the floor and ceiling line, the ceiling to be measured from wall to wall, as though all walls were vertical, for contents of ceiling, and from floor to highest point of ceiling for height of wall.

OPENINGS.

Openings in plastering to be measured between grounds. No deductions to be made for openings of two feet or less in width. One-half of contents to be deducted for openings two feet or more in width. The contents on all store front openings to be deducted, and the contractor to be allowed one foot six inches for each jamb by the height.

All beams or girders projecting below ceiling line to have one foot in width by total length added for each internal and external angle.

No openings to be deducted from "solid" or "hollow" metal lath and plaster partitions nor for openings in suspended ceilings containing less than 100 square feet, where furring is carried around such openings by plasterer. No openings to be deducted from cement wainscot or base.

CORNER BEADS, ARCHES, ETC.

All corner angles of more or less than 90 degrees, beads, "bullnoses," quirks, rule joints, and moldings, to be measured by the lineal foot on their longest extension, and one foot for each stop or miter.

CORNICES.

Length of cornices to be measured on walls. Plain cornices of one foot girth or less to be measured on walls by the lineal foot. Plain cornices exceeding one foot girth to be measured by the superficial foot. Add one lineal foot to girth for each stop or miter. Enriched cornices (cast work), by the lineal foot for each enrichment.

Arches, corbels, brackets, rings, center pieces, pilasters, columns, capitals, bases, rosettes, bosses, pendants and niches by the piece. Ceiling or frieze plates over eight inches wide by the square foot.

COLUMNS.

All columns to be measured by the lineal foot for plain plastered columns.

CEMENT WAINSCOTING AND BASE.

All cement wainscot to be measured by the square foot, and cement base by the lineal foot.

GROUND.

All grounds for various classes of work to be as follows, unless expressly specified to the contrary:

Grounds for 2-coat lath work.....	7 $\frac{1}{2}$ inch
Grounds for 3-coat lath work.....	1 inch
Grounds for 3-coat metal lath work.....	5 $\frac{1}{2}$ inch
Grounds for 3-coat metal lath work, on 1 $\frac{1}{2}$ -inch iron furring.....	11 $\frac{1}{2}$ inch
Grounds for 3-coat metal lath work, on 1-inch iron furring.....	15 $\frac{1}{2}$ inch
Grounds for hard mortar metal lath work.....	3 $\frac{1}{2}$ inch
Grounds for hard mortar metal lath work, on 1 $\frac{1}{2}$ -inch iron furring.....	11 $\frac{1}{2}$ inch
Grounds for 2-coat work on brick or tile.....	5 $\frac{1}{2}$ inch
Grounds for hard mortar on brick or tile.....	5 $\frac{1}{2}$ inch
Grounds for hard mortar lath work.....	7 $\frac{1}{2}$ inch
Grounds for plaster board.....	5 $\frac{1}{2}$ inch

Where metal lath is spoken of it applies to all wire or metal lath.

The Employing Plasterers' Association of Chicago solicit the co-operation and support of Architects and others in the Association's efforts to set the highest standard possible for plastering.

In many of the branches of building construction, efforts are tending towards the use of better material and workmanship, no material or finish for a building combines so fully the essentials for fire protection and sanitation at so low a cost to the owner as does plastering, and no other material that enters so largely into the construction of a building presents so large an area of visible surface as does plastering. The cost of plastering represents only a small percentage of the total cost of a building.

It is a necessary base for the most expensive decorations and in itself provides the requisites necessary for a finish interior. The association believes that so important an element in the construction and finish of a building is worthy of being well done, and that the best workmanship and material if specified and called for will more than compensate owners and architects in their requirements for such grade of work. The Employing Plasterers' Association of Chicago respectfully submits the following outline specification for lath and plaster work; all trade names of material have been omitted. Architects will find a list of standard materials in the Hand Book and elsewhere.

TENTATIVE OUTLINE SPECIFICATION FOR LATH AND PLASTER WORK.

Sand. All sand to be clean, sharp lake sand.

lime. All lime to be fresh burned lump lime.

Lath. All wood lath to be No. 1 white pine 1 $\frac{1}{2}$ " lath free from sap and bark and even edged.

Nails. To be 3 penny fine 16 gauge wire nail.

Wire Lath. To be No. 18 Washburn and Moen gauge .0475 $\frac{3}{4}$ " mesh painted or No. 24 gauge metal lath painted with ribs not less than 1 $\frac{1}{2}$ " wide, lath cut from sheet metal shall weigh not less than 4 $\frac{1}{2}$ per square yard.

Stucco. To be fresh.

Hair. To be well whipped cattle hair.

Fibre. To be long vegetable fibre.

Portland Cement. To be a brand that shall meet the requirements of the standard specifications for Portland Cement of the American Society for testing materials as revised to date by said Society.

Hard Plaster. To be an approved straight gypsum plaster.

Metal Corner Beads. To be a bead not less than 24 gauge galvanized.

Lathing. All wood lath to be nailed to each stud joist or bearing with joints broken not over seven lath to a break, no diagonal nor vertical lathing allowed, a full 3 $\frac{1}{2}$ " key to be left for lime mortar and not less than a full 1 $\frac{1}{2}$ " for hard plaster.

lime Mortar. To be composed of clean coarse sand, fresh lump lime and hair and fibre in proper proportions and to be well slaked and protected.

Putty. Lime putty to be run off in a tight putty box, thoroughly tempered and screened through a fine putty screen.

Hard Finish. To be composed of cold run lime putty, fresh plaster of paris and sand to be well troweled to a smooth even surface, free from blisters, checks and other imperfections.

Sand Finish. All float sand finish to be composed of lime putty and sand to be

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water floated with a float to an even granular or sand surface.

Scratch Coat. All scratch coating to be well laid on and surface covered with a full coat which is to be scratched with wire scratcher to be well under cut for the brown coat, all lime mortar scratch coating to be dry before applying the brown coat.

Brown Coat. All brown coating to be well applied, allowing only sufficient space for the finish coat, brown coat to be rodged and screeded with all angles straight and true, all hard plaster to be mixed in accordance with the directions of the manufacturer and no hard mortar to be floated with water nor shall any "dead" material be retempered or used.

Wire or Metal Lath. Shall be lapped at each joint or seam and shall be stapled every six inches with blued or galvanized staples.

Band Iron Furring. The following shall be furred with $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " or 1" corrugated band iron furring, such furring to be stapled to bearings and the wire or metal lath to be stapled over such band iron furring.

Suspended Ceilings. To be constructed with $\frac{1}{2}$ " or 2" flat bars, angles or channels as may be called for, such principals shall be spaced 4' 0" on centers, hung with flat bar or not less $\frac{1}{4}$ " rod hangers every 4' 0" securely fastened with approved clips to the structural framing or through the floor construction, in the event these hangers go through the floor construction they shall be provided with 6" channels or flat bar anchors, no hanger shall be supported from the bottom flange of the tile arch. The flat bar, angle or channel runners shall be cross furred 12" on centers with $\frac{3}{4}$ " steel channels, securely secured to the principals with rod clips, entire construction to be lathed with No. 18 W. M. gauge $\frac{3}{8}$ " mesh painted wire lath or No. 24 U. S. Gov. standard gauge metal lath, lath to have lapped edges at each joining and to be tied to the channel furring every 6" with 18 gauge galvanized tie wire.

Furring. All false beam or cornice furring to be constructed of $\frac{3}{4}$ " channel or 1" flat bar brackets not over 2' 6" apart lined out with intermediate furring supports and anchored or toggle bolted into the construction to be made to conform to the design so as to allow for a minimum of plaster, such brackets to be covered with 18 gauge wire or 24 U. S. Gov. gauge metal painted lath secured with 18 gauge galvanized tie wire, such furring to conform to the latest and best practice as to durability of construction.

Cornice Work. All moulded beams and cornices will be screeded and run in place with moulds, with true lines and accurate mitres.

Ornamental Work. All ornamental work to be modeled by artistic modelers who will be approved by the architects. Models to be submitted for approval and no casts to be made until such models have been approved, all patterns to be gotten out by skilled mechanics with true and accurate lines.

Casts. All casts to be well made, the contractor to supply a sufficient number to meet the requirements of the job, all casts to be made in line, well and truly undercut and free from warps and other irregularities supplying all necessary shrinkers and stretchers.

Rough Casting. Lath the exterior of the house with 18 gauge wire or 24 U. S. Gov. metal painted lath stapled over 1" band iron furring scratch coat with mortar composed of 2 vols. of coarse, sharp sand 1 vol. of Atlas or equal, Portland cement, to which mixture add 15% of rich lime mortar, thoroughly scratched and undercut when this coat was "set," brown with mortar composed of 3 vols. sharp sand to 1 vol. Portland cement rod and straighten all surfaces and when this coat has "set" rough cast with mortar composed of 3 vols. of sharp sand or pebbles to 2 vols. Portland cement dashed

on surface with a scoop or paddle to an even artistic finish.

Exterior Plastering on Wood Lath. Lath the exterior with No. 1 soft pine one-inch lath, nailed to each stud furring or bearing with not less than a 3 penny nail with full open $\frac{3}{8}$ " key space and not over seven lath to a break, plaster with 3 coats of cement plaster as called for under exterior plaster on metal lath, note the use of "hard plasters" so called are not recommended for exterior plastering.

Concrete Walls and Columns. All work on concrete walls and columns shall have such concrete well brushed with steel brushes and such concrete shall then be covered with a light coat of an approved bond cement as a bonding coat for the finish coat.

Concrete Ceilings. Shall first be washed with a solution of muriatic acid and such ceilings shall then be plastered as above.

Painted Walls. Walls that are to be coated with waterproofing shall first be scratch coated, then browned and finished.

Patching of Plaster. All patching of plaster damaged by other mechanics shall be paid for at the uniform scale of prices adopted by the Employing Plasterers' Association of Chicago, which scale of prices is set forth in the Hand Book.

Workmen's Compensation. This contractor shall insure his workmen under the provisions of the Workmen's Compensation Laws of the State of Illinois. This contractor shall also insure his liability for injury or death to "the public."

Scaffold. This contractor shall supply all necessary tools, scaffold and other appliances necessary to fulfill the requirements of the job, all scaffolding to be erected and maintained in accordance with the laws of the State relating to scaffolds.

Rubbish. This contractor shall from time to time and when so notified by the architects remove all his rubbish from the premises.

Guarantee. This contractor shall guarantee for the period of one year defects in the plastering caused by the use by him of defective workmanship or defective material.

Distributions. The following parts of the building with lathed-furred-corniced-plastered.

Requirements. By Building Code in buildings of ordinary construction. At least two coats of plaster on all wood lath to $\frac{7}{8}$ " grounds.

By Union. All plain and ornamental plaster to the same contractor, the base coat of Portland cement under encasitic tile, cement base when installed independent of the floor or if 6" or more in height. All plastering regardless of the nature of the structure or of the material used.

RECOMMENDATIONS.

The use of soft pine lath, specify No. 1 white pine lath nailed to each stud, joist or bearing with 3 d. fine 16 gauge wire nails, with joints broken at least once in each seventh course or lath.

For better residence work specify one inch lath as above.

Wire or metal lath, specify No. 18 Washburn and Allen gauge wire lath $\frac{3}{8}$ " mesh painted, or No. 24 U. S. Gov. standard metal lath painted, for better class work specify wire lath woven from galvanized strand or metal lath galvanized.

The use of wire or metal lath plastered insures slow burning construction, helps to prevent settlement cracks and bonds and ties all parts of the structure together, its use is called for in almost every building, particularly on basement ceilings to prevent or retard fire on ceilings with long span joist construction on store ceilings and under other space subject to heavy use or abuse. Its use should also be general in all better class building, in rated buildings its use throughout entitles it to better classification for insurance.

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three coat plastering. This will insure a far better class of work, a better bonding together of buildings of ordinary construction, due to the use of a greater body of material. The application of the second base coat enabling one to straighten out rod and line work not possible in the use of two-coat work. Specify three-coat dry work, first coat to be a scratch coat well scratched and under cut. When dry, apply a brown coat, this brown coat to be screened and rodded and when dry apply a finish coat.

The following suggestions are offered for guidance:

Sand. The use of clean, coarse, sharp lake sand is essential for good plastering.

Metal Lath. Should be laid with lapped edges or joinings and should be stapled to bearings every 6". No suspended ceilings should be supported from the bottom or soffit of tile.

Portland cement base coat behind encaustic tile, Opalite or kindred material should be specified under "Plastering" with one rodded coat scratched on tile or brick or a scratch and rodded brown coat scratched on metal or wire lath. We do not recommend Portland cement direct to gypsum partition or gypsum furrings.

Damp proofed, waterproofed or painted walls and ceilings are required to be given 3 coats. If a finish coat is desired, it should be so specified. All lathing plain and ornamental plastering should be specified under one heading in order to avoid divided responsibility for final results.

JURISDICTION CLAIMS.

By Plasterers' Union, any and all plastering regardless of the nature of the material, or of the structure to which it is applied, including Sengliola made under the "New Process" so called.

By Lathers' Union, all lathing, metal corner beads and all light iron furring designed, specified or used primarily as a support for lath and plaster, including "H Rib."

By Rodcarriers and Building Laborers' Union, all scaffolding erected for the use of plasterers.

PATCHING OF PLASTERING AFTER OTHER TRADES.

Patching of plastering after other mechanics shall not be done as a part of the contract price, and shall be paid for at the following scale of prices which have been adopted by and are recommended by the Employing Plasterers' Association of Chicago.

Plasterer foreman..	\$1.25	per hour
Plasterer journeyman	1.00	" "
Lather	1.00	" "
Plasterer laborers..	.70	" "
Mortar	2.00	" bbl.
Putty	2.50	" "
Stucco .....	.75	" cwt. jute sack
Cement .....	.75	" " " "
18 gauge $\frac{3}{8}$ " mesh		
painted wire lath		
or 24 gauge expanded metal		
painted .....	.30	" yard
1½" pine lath.....	.35	" bunch

Where seven or more men are employed in one gang on same kind of work, foreman's time will be charged continuous while work is going on, where less than seven men are employed in one gang on same kind of work, foreman's time shall be counted one hour for each seven hours of men aggregate time employed on this work, unless foreman's time is required constantly, when he shall be so paid.

CITY ORDINANCE.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 605 of the Chicago Code of 1911 be and the same is hereby amended so as to read as follows:

605. Wood Lathing and Plastering. (a) In all buildings of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with these specifications:

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least two coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

(b) In every building of ordinary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms not used for habitation or living purposes), throughout the building shall be covered with not less than two coats of plaster of the thickness and quality hereinbefore in this section prescribed.

Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in the room used for the purpose of Class I; and provided further, that where such building of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisors:

The ceiling of the room or rooms used for the purpose of Class I shall first be plastered with at least one coat of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joint in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal plates are applied on walls of buildings of ordinary construction containing one or more rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this ordinance for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every studding with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

Section 2. This ordinance shall be in force and effect from and after its passage and due publication.



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SUGGESTIONS FOR FIRMS ISSUING CATALOGUES AND PRINTED MATTER

Architects are technically educated and are charged with selection on technical merit.

Exact and specific technical detail appeals to an architect because it enables him to judge quickly and correctly.

Drawings to scale of parts or the whole make arrangement or mechanism most quickly clear to the technically educated.

Testimonials from those technically incompetent to judge carry no weight with the competent.

Architects want authentic technical information about all building materials and devices.

Architects do not want to wade through a sea of laudatory verbiage in order to discover an islet of real usable information.

Architects must cover an immense variety and amount of detail in selecting the numerous materials that enter into a building.

Where much detail is handled by a single individual, success is dependent on system.

Information to be immediately available for architects must be classified so that each detail can be considered separately and in order.

Advertisers recognizing these principles and presenting exact technical information under proper classification, free from irrelevant matter and in convenient form for filing, so as to be available when that item is up for consideration, are most likely to secure satisfactory results from their efforts.

It is believed that most architects have their own particular system of filing and classification and would not take kindly to any advertising scheme contemplating the placing of filing cabinets in architects' offices and distribution by those interested in the promotion of advertising scheme. Architects do not take kindly to allowing outsiders access to their private catalogue filing cabinets, and it is impractical to have two filing systems in the same office.

Practical requirements in the preparation of specifications make it necessary for architects to divide their specifications into topics very similar to trade divisions brought about by divisions of labor promulgated by labor authorities, and no single division or chapter of a catalogue should contain matter pertaining to more than one trade; un-

less the material referred to is used by several trades. It is hoped that eventually the architects may agree on a satisfactory universal building material classification or index. But it is certain that this time has not yet arrived and that no person not actually having had extended experience in the preparation of architects' specifications is capable of preparing such an index that would be practical.

STANDARD SIZES Requested by Architects

Believing that uniform practice by the various publishers of catalogues and literature for distribution to architects is desirable for all concerned, and wishing to be in accord with the recommendations of the American Institute of Architects, the Illinois Society of Architects advise that all literature for this purpose be prepared to comply as nearly as possible with the conditions set forth, as follows:

First: That 8½"x11" shall be the standard sized page for all general catalogues and bulletins intended for permanent filing by architects; thus making a size convenient for filing in the standard letter-size vertical filing cabinets, such as may be procured from any concern dealing in office filing devices.

Second: That 3¾"x8½" shall be the standard size for post cards and pocket editions intended for the use of architects; thus making a size convenient for filing three to the page, side by side, in standard letter-size vertical filing cabinets; or one to the page, on side, in standard vertical check files; or on end in standard legal document files; also convenient for mailing in standard legal size envelopes.

Third: That all catalogues should be issued in the form of separate bulletins, or chapters separated by a blank page, each treating of but one subject, on both sides of the same sheet, so as to make separation easy for classification purposes.

Fourth: That it is important to have pages cut to exact size; if over size in any particular they may not go into files; if under size, they may be overlooked in running through the files hastily.

Fifth: That these recommendations go into effect January 1, 1915, and that following that date, architects be advised to decline to receive literature for filing which does not comply with standard sizes.

Illinois Society of Architects

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Select No. 1	"	"	"	"	"	"	"
No. 1 Factory	"	"	"	"	"	"	"

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Clear	"	"	"	"	"
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Sappy Clear Quarter Sawed White Oak	"	"	"	"	"	"
Select No. 1 White Oak - - - - -	"	"	"	"	"	"
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Clear Quarter Sawed Red Oak - - -	"	"	"	"	"	"
Sappy Clear Quarter Sawed Red Oak -	"	"	"	"	"	"
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STANDARD SPECIFICATIONS FOR SOUTHERN YELLOW PINE TIMBERS

As Recommended by The Illinois Society of Architects

DEFINITION FOR SOUTHERN YELLOW PINE.

(Authorized reprint from the copyrighted Standards of The American Society for Testing Materials, Philadelphia, Pa.)

Southern Yellow Pine.—This term includes the species of yellow pine growing in the Southern States from Virginia to Texas, that is, the pines hitherto known as long leaf pine (*Pinus palustris*), short leaf pine (*Pinus echinata*), loblolly pine (*Pinus taeda*), Cuban pine (*Pinus heterophylla*) and pond pine (*Pinus serotina*).

Under this heading two classes of timber are designated: (A) dense Southern yellow pine and (B) sound Southern yellow pine. It is understood that these two terms are descriptive of quality rather than of botanical species.

(a) **Dense Southern Yellow Pine** shall show on either end an average of at least six annual rings per inch and at least one-third summer wood, or else the greater number of the rings shall show at least one-third summer wood, all as measured over the third, fourth, and fifth inches of a radial line from the pith. Wide-ringed material excluded by this rule will be acceptable, provided that the amount of summer wood as above measured shall be at least one-half.

The contrast in color between summer wood and spring wood shall be sharp and the summer wood shall be dark in color, except in pieces having considerably above the minimum requirement for summer wood.

In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over 3" on an approximate radial line beginning at the edge nearest the pith in timbers over 3" in thickness and on the second inch (on the piece) nearest to the pith in timbers 3" or less in thickness.

In dimension material containing the pith but not a 5" radial line, which is less than 2x8" in section or less than 8" in width, that does not show over 16 sq. in. on the cross-section, the inspection shall apply to the second inch from the pith. In larger material that does not show a 5" radial line the inspection shall apply to the three inches farthest from the pith.

The radial line chosen shall be representative. In case of disagreement between purchaser and seller the average summer wood and number of rings shall be the average of the two radial lines chosen.

(b) **Sound Southern Yellow Pine** shall include pieces of Southern pine without any ring or summer wood requirement.

GENERAL TIMBER SPECIFICATIONS.

All timber except No. 1 Common must be free from defects such as injurious ring or round shakes, and through shakes that extend to the surface; unsound and loose knots, and knots in groups that will materially impair the strength. Seasoning checks and discolored sap shall not be considered defects in any grade.

KNOTS.

(Adopted by the American Society for Testing Materials, August 21 1915.)

Knots shall be classified as round and spike in form and for quality as sound, encased, loose and unsound.

A **round knot** is one which is oval or circular in form.

A **spike knot** is one sawn in a lengthwise direction; the mean or average width shall be considered in measuring these knots.

A **sound knot** is one which is solid across its face and which is as hard as the wood surrounding it; it may be either red or black, and is so fixed by growth or position that it will retain its place in the piece.

An **encased knot** is one whose growth rings are not intergrown and homogeneous with the growth rings of the piece it is in. The encasement may be partial or complete; if intergrown partially or so fixed by growth or position that it will retain its place in the piece, it shall be considered a sound knot; if completely intergrown on one face, it is a watertight knot.

A **loose knot** is one not firmly held in place by growth or position.

A **rotten knot** is one not as hard as the wood it is in.

WANE.

Wane is bark, or the lack of wood from any cause, on edges of timbers.

SHAKES.

Shakes are splits or checks in timbers which usually cause a separation of the wood between annual rings.

Ring shake: An opening between the annual rings.

Through shake: A shake which extends between two faces of a timber.

Shakes not hereinbefore described unless known to have extensive penetration shall not be considered a defect under this classification.

SIZES.

All rough timber, except No. 1 Common, must be full size when green. One-quarter inch shall be allowed for each side surfaced.

LENGTHS.

Standard lengths are multiples of two feet, eight to twenty feet, inclusive, extra lengths are multiples of two feet, twenty-two feet and longer. When lineal average is specified, standard of lengths shall be multiples of one foot.

GRADES OF TIMBERS.

HEART TIMBERS.

All timber specifications, except "Merchantable" specifying heart requirements, shall be considered as a special contract, and shall specify whether the heart requirements refer to cubical contents or surface measurements in each piece.

NO. 1 COMMON TIMBERS.

May be either Dense or Sound Pine.

Common timbers rough 4x4 and larger shall be not more than 1" scant at any point when green, and be well manufactured and may have 1½" wane on one corner one-third the length of the piece, or its equivalent on two or more corners; the wane measured on its face.

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Timbers 10x10 in size may have 2" wane as above; the larger sizes may have wane as above in proportion to sizes.

The diameter of any one knot shall not exceed 2" in 4x4 to 6x6; 2½" in 6x8 to 8x10; 3" in 10x10 to 10x12; 3½" in 12x12 to 12x14; 4" in 14x14 to 14x16; 4½" in 16x16 to 16x18. In sizes not mentioned the diameter of knots admissible will increase or decrease in proportion to the size of the timbers on same basis as above specified.

In determining the size of knots, mean or average diameter shall be taken, or the equivalent of the above in grouped knots at any one point. Shakes one-sixth the length of the piece, small unsound knots and a limited number of pin worm holes, well scattered, are inadmissible.

SQUARE EDGE AND SOUND TIMBERS.

May be either Dense or Sound Pine.

Square edge and sound timbers shall be well manufactured and conform to the General Timber Specifications, admitting sound knots, and shall be free from wane.

MERCHANTABLE TIMBERS.

May be either Dense or Sound Pine.

All merchantable timbers shall be well manufactured and conform to the General Timber Specifications.

Sizes under 9" on the largest dimension, shall show two-thirds or more heart surface on one of the wide faces; sizes 9" and over on the largest dimension shall show two-thirds or more heart on both of the wide faces. When sticks are square the face showing the most heart shall govern the inspection on sizes under 9", and the two faces showing the most heart shall govern the inspection when 9" and over. Heart showing the full length, even if not two-thirds of the area as above, shall meet the requirements of this quality.

Wane not exceeding one-eighth of the dimension of the face and one-quarter of the length of the piece on one corner, or the equivalent on two or more corners, on not to exceed ten per cent of the pieces, shall be admitted.

SELECT STRUCTURAL MATERIAL.

(A rule incorporating suggestions by the United States Forest Service.)

REQUIREMENTS FOR DENSITY AND RATE OF GROWTH.

1. Shall contain only sound wood and be well manufactured.

2. Shall conform to the definition of Dense Southern Pine as adopted by the American Society for Testing Materials, August 21st, 1915, shown on page 6.

For the purpose of determining whether any given piece meets the requirements for density and rate of growth, the following rule, suggested by the United States Forest Service, shall be applied. It will be sufficient if either end passes the inspection.

(1) Pith Present or Accurately Located.

(A) Radial line of 5" present.

(a) Apply inspection over third, fourth and fifth inches.

(B) Radial line of 5" not present.

(a) Apply inspection to the second inch on 2x3, 2x4, 2x6, 3x3, 3x4, 4x4, or any other dimension material that has less than 16 square inches on the cross section.

(b) In the larger material apply inspection to the 3 inches farthest from the pith.

(2) Pith Not Present or Cannot be Accurately Located.

(A) Material over 3" thick apply inspection to three inches nearest the pith.

(B) Dimension material 3" or less in thickness apply inspection to second inch of the piece nearest the pith.

(3) The Radial Line Chosen Shall Show a Representative Number of Annual Rings of Growth and Per Cent of Summer Wood.

Restrictions on Knots in Beams.

3. Shall not have in Volume 1 sound knots greater in diameter than one-fourth the width of the face on which they appear—maximum knot 1½". Shall not have in Volume 2 sound knots greater in diameter than one-half the width of the face on which they appear—maximum knot 3 inches.

The aggregate diameter of all knots within the center half of the length of any face shall not exceed the width of that face.

The diameter of a knot on the narrow or horizontal face of a beam is to be taken as its projection on a line perpendicular to the edge of the timber. On the width or vertical face, the smallest dimension of a knot is to be taken as its diameter.

Restrictions on Knots in Columns.

4. Shall not have sound knots greater in diameter than one-third the least width of the column—maximum knots 4 inches.

Restrictions on Shakes and Checks in Beams.

5. Round or ring shakes shall not occupy, at either end of a timber, more than one-fourth the width of green material, nor more than one-third the width of seasoned material.

Any combination of checks and shakes which would reduce the strength to a greater extent than the allowable round-shakes will not be permitted. Shakes shall not show on the faces of either green or seasoned timber.

Restrictions on Cross Grain in Beams.

6. Shall not have diagonal grain with slope greater than one in twenty in Volume 1.

ABBREVIATIONS OF TIMBER GRADES.

For the purpose of branding timbers with the names of the grades it is recommended that the following abbreviations be used:

SQ EDG-SD — Square Edge and Sound.

NO 1 COM — No. 1 Common.

MERCH — Merchantable.

SEL, STRUC — Select Structural.

ARCHITECTS SPECIFICATIONS FOR SOUTHERN YELLOW PINE STRUCTURAL TIMBERS.

(1) When Both Maximum Durability and Strength Are Required.

Longleaf southern yellow pine of "select structural material grade" in accordance with the definition of "Dense Southern Yellow Pine" as adopted by the American Society for Testing Materials (August, 1915), and the Southern Pine Association ("Density Rule" book, March 15, 1916). To be dressed to standard sizes conforming to the rules of the Southern Pine Association and branded in accordance with the official requirements of that Association.

(2) When Strength Is Required Without Special Reference to Durability.

Southern yellow pine of "select structural material grade" as defined in Section (1) above. To be dressed to standard sizes conforming to the rules of the Southern Pine Association and branded in accordance with the official requirements of that Association.

(3) When Used Without Reference to Durability or Maximum Strength.

No. 1 Common southern yellow pine timbers of "dense" grade as defined in the "Timber Rule" book of the Southern Pine Association (March 15, 1916). To be dressed to standard sizes conforming to the rules of the Southern Pine Association.

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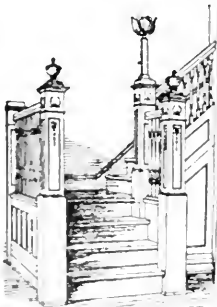
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(4) When Used for Joists, Studs, etc., in Ordinary or Minor Structures Without Reference to Durability or Maximum Strength.

No. 1 Common southern yellow pine, as defined in the "Timber Rule" book of the Southern Pine Association, March 15, 1916. To be dressed to standard sizes conforming to the rules of that Association.

FOR SOUTHERN YELLOW PINE HEAVY FACTORY AND LAMINATED FLOORING.

(5) When Durability and Maximum Strength Are Required.

"Dense" southern yellow pine of "merchantable grade" as defined in the "Timber Rule" book of the Southern Pine Association (March 15, 1916). To be dressed to standard sizes conforming to the rules of that Association and branded in accordance with the official requirements of that Association.

(6) When Strength Is Required Without Reference to Durability.

Southern yellow pine of "No. 1 Common Timbers" as defined in the "Timber Rule" book of the Southern Pine Association (March 15, 1916). To be dressed to standard sizes conforming to the rules of that association.

Note.

In lieu of the branding of timber above specified, the contractor may at his option arrange to have all material furnished under this specification inspected by the Inspection Department of the Southern Pine Association, in which event the contractor shall furnish and deliver to the architect a certificate showing that all material delivered complies with the architect's specifications. The entire expense of said inspection must be paid by the contractor.

Reinspection.

Should the architect demand that any material delivered be reinspected the said inspection shall be made by the official inspectors of the Inspection Bureau of the Southern Pine Association or Lumbermen's Association of Chicago. Should ninety-five per cent (95%) or more of the material inspected be approved as complying with the grade specified, the inspection fee shall be paid by the owner. Should five per cent (5%) or more of the material inspected be rejected by the said Inspector as not complying with said grading rules, all inspection fees shall be paid by the contractor.

STANDARD SPECIFICATIONS FOR GRADES OF SOUTHERN YELLOW PINE FLOORING MARCH 15, 1916.

No. 1 COMMON FLOORING is the combined grade of C and D Flooring, and will admit all pieces that will not grade "B," and are better than No. 2 Common.

No. 2 COMMON FLOORING admits all pieces that will not grade as good as "D" flooring that can be used for cheap floors without a waste of more than one-fourth the length of any one piece. (See Sec. 26.)

No. 1 COMMON FACTORY FLOORING will admit of sound knots not over one-half the cross-section of the piece at any point throughout the length; pitch pockets, sap stain, shakes that do not go through, firm red heart, seasoning checks which do not show an opening through the piece, wane one-fourth inch deep on the face, a limited number of pin worm holes well scattered, loosened or heavy torn grain or other machine defects which will lay without waste, and pith knots which will not cause a leakage of grain. (See Secs. 35 and 123.)

"A" FLAT FLOORING must be practically free from defects on the face side and well manufactured.

"B" FLAT FLOORING will admit any two of the following or their equivalent of combined defects: 15 per cent, sap stain, 15 per cent, firm red heart, three pin knots, one standard knot, three small pitch pockets, one standard pitch pocket, one standard pitch streak, slight torn grain, small seasoning checks, six pin worm holes.

"C" FLAT FLOORING will admit any two of the following defects or their equivalent of combined defects: 25 per cent, of sap stain, 25 per cent, of firm red heart, two standard pitch streaks; medium torn grain, or other machine defects that will lay without waste; slight shake that does not go through, or seasoning checks that do not show an opening through, two standard pitch pockets, six small pitch pockets, two standard knots or six pin knots, twelve pin worm holes.

EDGE GRAIN FLOORING shall take the same inspection as Flat Grain, except as to the angle of the grain. (See Sec. 23.)

HEART FACE EDGE GRAIN shall be free from sap on face side.

"D" FLAT FLOORING will admit the following defects or their equivalent of combined defects: Sound knots not over one-half the cross section of the piece in the rough at any one point throughout its length; three pith knots, pitch, pitch pockets, sap stain, firm red heart, seasoning checks that do not show an opening through, shake that does not go through, a limit of number of pin worm holes well scattered, loosened or heavy torn grain, or other machine defects that will lay without waste.

Pieces otherwise as good as "B" Flooring may have one defect like a knot hole that can be cut out by wasting 1½ inches of the length of the piece, provided both pieces are 16 inches or over in length after cutting out such defects.



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REVISED BASIS FOR PRICING EXTRA WORK

As recommended by the following organizations:

Builders' Association of Chicago.
Carpenter Contractors' Association.
Architectural Iron League.
Concrete Contractors' Association.
Chicago Master Steam Fitters Association.
Chicago Master Plumbers' Association.
Sheet Metal Contractors' Association.
Master Composition Roofers' Association.
Decorators' & Painters' Club.
Employing Plasterers' Association.
Pipe and Boiler Covering Employers' Association.
Electrical Contractors' Association.

At regular meetings held by the undersigned associations it was after full discussion unanimously decided that the below printed schedule would be fair as a basis for pricing labor per hour used in incidental extra work on buildings where members are doing work under contract; this, however, not to interfere with the individual rights of members to agree with Architects and Owners, at the time of making contract, for different unit prices than herewith recommended, but where work has been ordered without specific agreement as to unit price cost for labor, the following basis for such charges shall govern.

Use of Comp. Roofers Team and Kettle (inc. fuel) charged as one man.
Use of Hoisting Elevator and power for same \$2.00 per hour
Use of Boom Derrick and Engine, inc. power for same 5.00 per hour
Use of Breast Derricks 0.50 per hour
Use of Teams and Wagons, including Driver 1.00 per hour
Use of Pumps or Drills, Steam, Electric or Compressed Air, including necessary hose and power 1.00 per hour
Use of Jack Screws and Drums 0.25 per day

Where seven or more men are employed in one gang on same kind of work, foreman's time will be charged continuous while work is going on. Where less than seven men are employed in one gang on same kind of work, foreman's time shall be counted one hour for each seven hours of men's aggregate time employed on this work unless foreman's time is required constantly when he shall be so paid.

RATE OF WAGES

Paid per hour in the Building Trades of Chicago, Cook County and Vicinity.

Building Trade and Machinery	Wages	Joint Insurance under Liability and Compensation	Use of Tools and Appliances	Profit	Total Per Hour
Carpenter Foreman	1.00	.05	.00	.20	1.25
Carpenter Journeyman .....	.70	.04	.11	.15	1.00
Carpenter Laborer .....	.50	.03	.05	.10	.68
Mason Foreman	1.00	.06	.00	.19	1.25
Mason Journeyman .....	.75	.05	.10	.15	1.05
Mason Laborer .....	.45	.04	.06	.10	.65
Labor Foreman .....	.70	.05	.00	.15	.90
Mason Scaffold Builders and					
Foreman .....	.50	.04	.10	.11	.75
Scaffolders .....	.50	.05	.10	.10	.75
Carpenter Foreman .....	.50	.03	.05	.10	.68
Carpenter Laborer .....	.25	.02	.05	.10	.42
Riggers and Langers .....	.70	.06	.14	.10	1.00
Iron Setter Foreman	1.00	.16	.00	.19	1.35
Iron Setter Journeyman .....	.70	.10	.15	.10	1.05
Hoisting Engineer .....	.75	.11	.14	.10	1.10
Steam Fitter Foreman	1.00	.05	.00	.20	1.25
Steam Fitter Journeyman .....	.75	.04	.15	.16	1.10
Steam Fitter Helper .....	.40	.02	.09	.09	.60
Plumber Foreman	1.00	.04	.00	.16	1.20
Plumber Journeyman .....	.75	.03	.15	.12	1.05
Plumber Laborer .....	.45	.02	.10	.15	.72
Drum Layer .....	.55	.05	.15	.15	.90
Painter Foreman .....	.90	.05	.00	.20	1.15
Painter Journeyman .....	.70	.04	.10	.16	1.00
Decorater Foreman	1.00	.05	.00	.20	1.25
Decorater Journeyman .....	.90	.04	.11	.20	1.25
Copper Roller Foreman .....	.75	.05	.00	.20	1.00
Copper Roller Journeyman .....	.65	.03	.12	.15	.95
Lead Roller Foreman	1.00	.06	.00	.19	1.25
Lead Roller Journeyman .....	.70	.04	.15	.16	1.05
Tin Roofer .....	.40	.03	.10	.12	.65
Sheet Metal Foreman	1.00	.06	.00	.19	1.25
Sheet Metal Journeyman .....	.70	.05	.14	.16	1.05
Sheet Metal Laborer .....	.43	.03	.07	.12	.65
Copper Tin Foreman .....	.85	.06	.00	.14	1.05
Copper Tin Journeyman .....	.75	.05	.08	.09	.95
Copper Tin Helper .....	.525	.04	.055	.08	.70
Plasterer Foreman	1.00	.04	.00	.21	1.25
Plasterer Journeyman .....	.75	.03	.07	.15	1.00
Plasterer Laborer .....	.50	.02	.05	.10	.67
Plasterer Foreman	1.00	.02	.00	.18	1.20
Plasterer Journeyman .....	.70	.02	.13	.15	1.00
Plasterer Helper .....	.50	.02	.08	.10	.70
Plasterer Foreman	1.00	.02	.00	.18	1.20
Plasterer Journeyman .....	.75	.02	.12	.16	1.05

NOTE.—In case of questions as to fair dealing on the part of contractors or labor, architects are advised to present the matter to our committee on "Adjustment" who are in the best position to take up such matters with the various contractors and labor organizations, so as to secure an attentive hearing and investigation. This committee is constituted as follows: J. C. Llewellyn, chairman, Cent. 1969, 38 So. Dearborn Street; Irving K. Pond, Har. 2927, 64 E. Van Buren Street; Alfred S. Alschuler, Har. 2582, 28 E. Jackson Blvd. The various contractors' organizations of Chicago are represented by a joint association known as the Building Construction Employers' Association, telephone Franklin 3083, 133 W. Washington Street; E. M. Craig, secretary; Chas. Gindlee, president.

The various trade labor organizations in Chicago are represented by a central body called the Chicago Building Trades Council, telephone Main 1279, 365 W. Jackson Street; Mr. Simon O'Donnell, president; James J. Conroy, secretary.

The Building Construction Employers' Association and the building trades council have united in forming a joint arbitration board for the purpose of adjusting labor disputes.

Architects would do well to so divide their specifications as to comply with accepted trade divisions, thus avoiding jurisdictional disputes. Information as to accepted classification can be obtained from our committee.

MISCELLANEOUS AND USEFUL INFORMATION CONCERNING BUILDING ENGINEERING, TRADES AND MATERIALS.

The following pages contain tables, formulae, and miscellaneous information intended to be of assistance to architects in the preparation of plans, specifications, estimates, and the general supervision of the construction work. In order to make the classification simple and to follow a uniform system this matter is classified according to the Dewey System, see page 401, and the file or classification numbers are printed in small type at the head of each piece of matter falling under a different classification. As far as possible the names of authorities quoted are given but in some cases this has been impossible.

FILE 690.12

RULES AND FORMULAS FOR THE DESIGN OF SIMPLE WOOD BEAMS OR JOISTS.

When a beam is to be designed its length and the loads to which it is to be subjected are known, thus the maximum bending moment may be found.

The allowable-working-strength is assumed in accordance with engineering practice and must not be more than allowed by building laws, locally applicable. This allowable-working-strength is usually stated in municipal codes as a fixed number of pounds per square inch of cross sectional area, for each kind of material. This might just as well be stated in tons or any other unit of weight per square foot or any other unit of area, it being only important that whatever unit of dimension is used that the same unit shall be used both for areas, lengths and breadths.

Breadth-of-the-beam times the-square-of-the-depth divided by six equals Bending-Moment divided by allowable-working-strength per unit of area corresponding with unit of length used for stating the length and breadth of beam.

Bending-Moment (for beams uniformly loaded) equals weight-to-be-supported-per-unit-of-length times the-square-of-the-total-number-of-units-of-length divided by eight.

For a simple beam loaded with a single weight, the maximum-Bending-Moment (which is to be used in formula) equals the-entire-load times [(the-length-of-the-beam) minus (the-distance-of-the-load-from-the-left-hand-end)] times the-distance-of-the-load-from-the-left-hand-end-of-the-beam divided by the-length-of-the-beam.

If the load be movable the-distance-of-load-from-left-hand-end will be variable and the maximum-moment will be developed when the load is at the middle where the maximum-Bending-Moment is equal to one-fourth-the-load times the-length-of-the-beam. Placing the entire load on a beam at its center therefore produces the maximum strain that it is possible to produce on such beam by any position of such load.

APPLICATION OF ABOVE PRINCIPLES.

M=maximum bending moment.

S=the tensile or compressive unit stress per square inch allowable by building code or engineering practice for the material selected (See Section 539, Chicago Municipal Code, using the smallest value where there is a difference between compression and tension strength.)

l=length in inches of beam between supports.

b=breadth in inches of the beam.

d=depth in inches of the beam.

w=weight in pounds on beam including the weight of the beam itself per each inch of length.

W=total weight in pounds on beam = l w.

FOR UNIFORM LOADING.

$$b = \frac{3 w l^2}{4 d^2 S} = \frac{3 W l}{4 d^2 S} = \text{breadth of beam.}$$

$$d = \sqrt{\frac{3 w l^2}{4 b S}} = \sqrt{\frac{3 W l}{4 b S}} = \text{depth of beam}$$

To find b it is necessary to assume a value for d. Also to find d it is necessary to assume a value for b. In case it is found that the value by formula is too large or too small for practical use, then assumed value must be changed so as to bring the computed value to a practical size.

LOADS IN POUNDS (UNIFORMLY DISTRIBUTED)
TABLE OF STRENGTH OF YELLOW PINE BEAMS
WEIGHT OF BEAM INCLUDED

1910 CHICAGO BUILDING ORDINANCE

Fibre Stress 1300 lb. in². Shear 130 lb. in².

Each beam $\frac{3}{8}$ in. less than nominal width and depth

STRENGTH
Unplastered Construction
Width in Inches

DEFLECTION LIMITED
Plastered Construction
Width in Inches

2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	Span in feet.	2 in.	3 in.	4 in.	6 in.	8 in.	10 in.
6 in. Beam=5% in. Load in pounds.							6 in. Beam=5% in. Load in pounds.					
1491	2409	3327	5163	.....	.....	5	1491	2409	3327	5163	.....	.....
1243	2008	2773	4303	.....	.....	6	1243	2008	2773	4303	.....	.....
1066	1722	2378	3690	.....	.....	7	913	1475	2037	3161	.....	.....
932	1506	2080	3228	.....	.....	8	699	1129	1559	2419	.....	.....
828	1338	1848	2868	.....	.....	9	553	893	1233	1913	.....	.....
746	1205	1664	2582	.....	.....	10	450	727	1004	1558	.....	.....
678	1095	1512	2346	.....	.....	11	371	599	827	1283	.....	.....
621	1003	1385	2149	.....	.....	12	310	501	692	1074	.....	.....
8 in. Beam=7% in.							8 in. Beam=7% in.					
1955	3158	4361	6767	9173	.....	7	1955	3158	4361	6767	9173	.....
1711	2764	3817	5923	8029	.....	8	1711	2764	3817	5923	8029	.....
1523	2460	3397	5271	7145	.....	9	1351	2182	3013	4675	6337	.....
1370	2213	3056	4742	6428	.....	10	1094	1767	2440	3786	5132	.....
1245	2011	2777	4309	5841	.....	11	905	1462	2019	3133	4247	.....
1141	1843	2545	3949	5353	.....	12	761	1229	1697	2633	3569	.....
1053	1701	2349	3645	4941	.....	13	647	1045	1443	2239	3035	.....
978	1580	2182	3386	4590	.....	14	559	903	1247	1935	2623	.....
914	1476	2038	3162	4286	.....	15	488	788	1088	1688	2288	.....
856	1382	1910	2964	4018	.....	16	428	691	954	1480	2006	.....
10 in. Beam=9% in.							10 in. Beam=9% in.					
2709	4376	6043	9377	12711	16045	8	2709	4376	6043	9377	12711	16045
2426	3919	5412	8398	11384	14370	9	2426	3919	5412	8398	11384	14370
2183	3526	4869	7555	10241	12927	10	2183	3526	4869	7555	10241	12927
1986	3208	4430	6874	9318	11762	11	1803	2913	4023	6243	8463	10683
1820	2940	4060	6300	8540	10780	12	1518	2452	3386	5254	7122	8990
1677	2709	3741	5805	7869	9933	13	1292	2087	2882	4472	6062	7652
1560	2520	3480	5400	7320	9240	14	1117	1804	2491	3865	5239	6613
1454	2349	3244	5034	6824	8614	15	972	1570	2168	3364	4560	5756
1365	2205	3045	4725	6405	8085	16	855	1381	1907	2959	4011	5063
1284	2074	2864	4444	6024	7604	17	757	1223	1689	2621	3553	4485
1212	1958	2704	4196	5688	7180	18	676	1092	1508	2340	3172	4004
1149	1856	2563	3977	5391	6805	19	606	979	1352	2096	2840	3584
1092	1764	2426	3780	5124	6468	20	546	882	1218	1890	2562	3234

Continued on next page.

2 in.	3 in.	4 in.	5 in.	6 in.	8 in.	10 in.	12 in.	Span in feet.	2 in.	3 in.	4 in.	5 in.	6 in.	8 in.	10 in.	12 in.
12 in. Beam = 1½ in.									12 in. Beam = 1½ in.							
3550	5750	7930	10100	12350	16600	21100	25500	9	3550	5750	7930	10100	12350	16600	21100	25500
3200	5160	7150	9100	11100	15000	19000	23000	10	3200	5160	7130	9100	11100	15000	19000	23000
2910	4700	6500	8300	10100	13700	17400	20900	11	2910	4700	6500	8300	10100	13700	17400	20900
2650	4300	5910	7560	9200	12450	15750	19000	12	2650	4050	5590	7110	8670	11720	14800	17900
2460	3960	5470	7000	8500	11500	14550	17590	13	2125	3440	4750	6080	7380	9990	12600	15200
2290	3670	5070	6500	7890	10650	13450	16300	14	1840	2960	4100	5235	6360	8600	10850	13150
2140	3440	4740	6080	7350	9930	12650	15200	15	1600	2590	3570	4550	5540	7500	9450	11450
1990	3210	4440	5660	6900	9340	11800	14250	16	1405	2270	3140	4000	4860	6590	8500	10080
1870	3025	4160	5330	6490	8760	11050	13380	17	1250	2020	2790	3550	4325	5860	7400	8980
1770	2860	3950	5050	6120	8300	10500	12700	18	1115	1795	2490	3160	3850	5210	6580	8000
1670	2700	3740	4760	5800	7850	9900	12000	19	1000	1615	2230	2840	3455	4695	5910	7150
1590	2575	3550	4530	5500	7480	9430	11400	20	900	1450	2000	2555	3110	4220	5325	6450
1530	2450	3400	4335	5280	7200	9000	10900	21	810	1320	1820	2320	2820	3840	4840	5840
1450	2350	3250	4150	5050	6850	8650	10300	22	745	1200	1660	2120	2580	3500	4410	5340
1390	2250	3100	3950	4800	6550	8300	10000	23	680	1100	1520	1940	2350	3200	4040	4870
1340	2150	2970	3800	4600	6250	7900	9550	24	630	1010	1400	1780	2160	2940	3710	4500
14 in. Beam = 1¾ in.									14 in. Beam = 1¾ in.							
4000	6450	8900	11400	13850	18700	23700	28700	11	4000	6450	8900	11400	13850	18700	23700	28700
3660	5900	8150	10400	12650	17150	21600	26200	12	3660	5900	8150	10400	12650	17150	21600	26200
3360	5450	7520	9600	11650	15800	20000	24200	13	3360	5450	7520	9600	11650	15800	20000	24200
3140	5060	7000	8910	10850	14700	18580	22500	14	3140	5060	7000	8910	10850	14700	18580	22500
2925	4725	6520	8310	10100	13700	17300	20950	15	2750	4450	6130	7810	9500	12850	16250	19700
2745	4345	6130	7810	9500	12850	16250	19620	16	2400	3875	5350	6830	8300	11240	14200	17200
2590	4170	5760	7350	8940	12150	15300	18500	17	2125	3440	4750	6050	7360	9950	12600	15210
2440	3940	5450	6940	8430	11410	14410	17450	18	1900	3070	4250	5410	6580	8930	11250	13600
2310	3740	5160	6590	8000	10810	13650	16550	19	1700	2740	3790	4840	5880	7960	10100	12150
2195	3550	4900	6240	7600	10260	13000	15700	20	1535	2480	3425	4370	5320	7200	9090	11000
2090	3360	4660	5940	7240	9800	12390	14950	21	1395	2255	3120	3980	4840	6550	8270	10000
2000	3250	4450	5700	6900	9400	11900	14300	22	1270	2050	2830	3600	4400	5950	7500	9100
1900	3090	4250	5430	6600	9000	11350	13700	23	1160	1870	2590	3300	4000	5450	6850	8300
1830	2950	4090	5200	6320	8600	10900	13100	24	1070	1720	2370	3070	3690	5000	6300	7600
16 in. Beam = 1½ in.									16 in. Beam = 1½ in.							
4410	7150	9860	12600	15400	20800	26400	31600	13	4410	7150	9860	12600	15400	20800	26400	31600
4100	6625	9150	11660	14200	19240	24280	29380	14	4100	6625	9150	11660	14200	19240	24280	29380
3830	6190	8540	10890	13240	17950	22650	27400	15	3830	6190	8540	10890	13240	17950	22650	27400
3580	5790	8000	10200	12400	16800	21205	25650	16	3565	5770	7970	10160	12350	16750	21190	25640
3380	5455	7545	9620	11700	15850	20000	24200	17	3180	5140	7095	9050	11000	14800	18820	22790
3185	5160	7120	9095	11050	14960	18900	22850	18	2840	4580	6325	8060	9810	13300	16800	20250
3020	4880	6745	8600	10450	14180	17900	21600	19	2540	4100	5655	7225	8790	11900	15050	18180
2865	4640	6400	8160	9925	13450	16980	20500	20	2290	3700	5105	6520	7930	10750	13550	16400
2740	4425	6110	7800	9480	12850	16200	19600	21	2080	3360	4640	5925	7200	9755	12310	14900
2610	4220	5825	7445	9050	12250	15490	18700	22	1895	3065	4240	5400	6560	8900	11230	13580
2500	4045	5590	7125	8660	11740	14810	17900	23	1740	2805	3880	4950	6025	8150	10300	12430
2400	3890	5370	6850	8150	11300	14300	17200	24	1600	2570	3580	4580	5580	7500	9500	11400
2300	3720	5150	6550	8000	10900	13700	16500	25	1470	2370	3300	4200	5100	6950	8750	10500
2220	3580	4930	6300	7650	10400	13100	15800	26	1360	2200	3030	3880	4700	6400	8100	9700
18 in. Beam = 1¾ in.									18 in. Beam = 1¾ in.							
4875	7860	10860	13860	16880	22850	28850	34950	15	4875	7860	10860	13860	16880	22850	28850	34950
4560	7370	10180	13000	15800	21400	27000	32650	16	4560	7370	10180	13000	15800	21400	27000	32650
4300	6950	9580	12210	14895	20180	25300	30750	17	4300	6950	9580	12210	14895	20180	25300	30750
4050	6550	9040	11520	14000	19000	24000	29000	18	4050	6550	9040	11520	14000	19000	24000	29000
3840	6210	8560	10930	13300	18030	22800	27500	19	3640	5880	8110	10350	12550	17080	21500	26100
3645	5895	8140	10350	12610	17100	21600	26050	20	3295	5320	7350	9350	11410	15400	19450	23550
3470	5610	7750	9890	12030	16300	20600	24850	21	3040	4900	6760	8630	10500	14200	17950	21700
3310	5350	7400	9450	11460	15550	19630	23750	22	2730	4400	6090	7750	9410	12750	16100	19500
3170	5120	7060	9000	10950	14850	18750	22650	23	2545	4110	5660	7230	8800	11900	15000	18200
3040	4920	6800	8625	10520	14260	18000	21800	24	2290	3700	5100	6510	7900	10700	13550	16400
2910	4700	6500	8300	10100	13700	17300	20800	25	2120	3400	4700	6000	7350	9900	12500	15100
2800	4510	6250	7980	9700	13200	16600	20000	26	1950	3150	4370	5600	6800	9200	11600	14000

TABLES OF WORKING STRESSES IN ORDINARY STRUCTURAL DESIGN

by BENJAMIN E. WINSLOW, M. W. S. E.

The tables and data given on pages 358, 359 and 360 are extracts from articles published by Mr. Winslow in "The Technograph"—(Editor)

ULTIMATE AND SAFE STRENGTH OF WOOD IN POUNDS PER SQUARE INCH

MATERIAL	Extreme Fiber Stresses				Compression with the Grain				Compression Across the Grain				Modulus of Elasticity				Weight per Cubic Foot	
	Ultimate		Safe		Ultimate		Safe		Ultimate		Safe		Ultimate		Ultimate		From	To
	From	To	To	Av.	From	To	To	Av.	From	To	To	Av.	From	To				
Long Leaf Pine.....	7000	14000		1500	6000	9000		1500	1000	2000		350	1,500,000	2,250,000	40	50		
Oregon Pine.....	7000	13000		1400	6000	9000		1400	900	1800		300	1,400,000	2,100,000	35	45		
White Oak.....	6000	12000		1300	5000	8000		1300	1500	3000		500	1,300,000	1,950,000	45	55		
Short Leaf Pine.....	6000	11000		1200	5000	8000		1200	900	1800		300	1,200,000	1,800,000	35	45		
Spruce.....	5000	10000		1100	4000	7000		1100	800	1600		250	1,100,000	1,650,000	30	40		
Norway Pine.....	5000	9000		1000	4000	6000		1000	700	1400		200	1,000,000	1,500,000	30	40		
White Pine.....	4000	8000		900	4000	6000		900	600	1200		200	900,000	1,350,000	25	30		
Fir.....	4000	7000		800	3000	5000		800	600	1200		200	800,000	1,200,000	25	30		
Hemlock.....	3000	6000		700	3000	4000		700	600	1200		200	700,000	1,050,000	25	30		
Cedar.....	3000	5000		600	3000	4000		600	500	1000		200	600,000	900,000	20	25		
MATERIAL	Shear with the Grain				Shear Across the Grain				Tension with the Grain				Elastic Limit		Modulus of Resilience			
	Ultimate		Safe		Ultimate		Safe		Ultimate		Safe		Ultimate		From	To		
	From	To	To	Av.	From	To	To	Av.	From	To	To	Av.						
Long Leaf Pine.....	400	800		150	4000	6000		1000	8000	15000		1700	6000	12000	3.0			
Oregon Pine.....	400	700		140	4000	5000		900	8000	14000		1600	6000	11000	3.0			
White Oak.....	400	1000		200	4000	6000		900	7000	14000		1500	5000	11000	3.0			
Short Leaf Pine.....	350	700		120	3000	5000		800	7000	13000		1400	5000	10000	2.5			
Spruce.....	300	600		110	3000	4000		800	6000	12000		1300	4000	9000	2.5			
Norway Pine.....	300	600		100	3000	4000		700	6000	11000		1200	4000	8000	2.5			
White Pine.....	300	600		90	2000	3500		600	5000	10000		1100	3500	7000	2.0			
Fir.....	250	500		80	2000	3000		500	5000	10000		1000	3000	6000	2.0			
Hemlock.....	200	400		70	2000	3000		500	4000	9000		900	2500	5000	2.0			
Cedar.....	200	400		60	2000	2500		400	4000	8000		800	2500	4500	1.5			

ULTIMATE AND SAFE STRENGTH OF CONCRETE IN POUNDS PER SQUARE INCH

Modulus of Elasticity of P. C. Stone Concrete 1:2:4—60 Days Old for Various Stresses	Initial Mod. of Elasticity.... E. for Stress of 400 lbs pr. sq. in.	Strength of 1:2:4 P. C. Stone Concrete for Various Ages	Modulus of Elasticity		Compression on Top Fibers of Beams		Modulus of Elasticity			
			Ultimate	Ultimate	Ultimate	Safe	From	To		
									From	To
		1 Day Old	2,000,000	200	300	0				
		2 " " " " " " " "	1,700,000	400	700	100				
		4 " " " " " " " "	1,600,000	600	1000	200		800,000	1,300,000	
		7 " " " " " " " "	1,500,000	900	1500	375		1,200,000	2,000,000	
		1 Month Old.....	1,400,000	1200	2000	500		1,600,000	2,600,000	
		2 " " " " " " " "	1,300,000	1400	2300	575		1,800,000	3,000,000	
		3 " " " " " " " "	1,100,000	1500	2500	625		2,000,000	3,300,000	
		6 " " " " " " " "	900,000	1600	2700	675		2,200,000	3,600,000	
		1 Year Old.....	600,000	1700	2900	725		2,300,000	3,800,000	
		2 " " " " " " " "	0	1800	3000	750		2,400,000	4,000,000	
E. for Ultimate Strength....										

These tables will cover variations of the material and give the range of strength that could be expected of good ordinary materials and workmanship. Inferior materials will come below the lowest limits given in these tables, and superior materials will come above the highest limits. The safe compressive unit stress to be used for long columns should be obtained from the use of some approved column formulae, which also should take care of possible eccentric applications of the load.

The safe extreme fiber stress for long, narrow beams and girders, including plate girders, not braced sideways, should also be obtained from some approved column formulae. In this manner the lateral strength of beams is

provided for.

The following method is believed to conform with good practice for computing loads in buildings:

Figure all parts of the building for the full dead load.
Figure joists and beams for the full live load.

Figure girders for 85 to 90 per cent of the live load.

Figure 1: the columns supporting the roof and top story of a building for the full live load. For each succeeding

story below, make a reduction of 5 per cent in the full live load coming on the columns. This reduction must how-

ever, not exceed 50 per cent of the full live load for a many stored building.

Figure the foundations for one-third of the full live load.

ULTIMATE AND SAFE STRENGTH OF MASONRY IN POUNDS PER SQUARE INCH.

MATERIAL	Compression			Safe Bearing	Modulus of Elasticity		Shear		Tension		Weight per Cubic Foot			
	Ultimate		Safe		Ultimate		Ultimate		Ultimate		Safe			
	From	To	Av.		From	To	From	To	From	To	From	To	From	To
Hard Brick Work in P. C.	2000	3000	200	275	1,500,000	2,500,000	.....	.....	100	200	20	130	150
Common " P. C.	1500	2500	175	250	1,500,000	2,500,000	.....	300	100	200	20	113	130
" " N. C.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	50	100	10	110	130
" " L. M.	800	1600	100	150	500,000	1,000,000	.....	.....	20	40	5	110	130
" " P. C. & L. M.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	50	100	10	110	130
Old Brick Work in P. C.	2000	3000	200	275	2,000,000	3,000,000	.....	.....	120	250	25	110	130
" " N. C.	1500	2500	175	250	1,500,000	2,000,000	.....	.....	70	120	15	110	130
" " L. M.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	25	50	7	110	130
Brick Piers in P. C.	1500	2500	175	250	1,500,000	2,500,000	.....	.....	100	200	20	110	130
" " L. M.	800	1600	100	150	500,000	1,000,000	.....	.....	20	40	5	110	130
Rubble Work in P. C.	1000	2000	150	200	1,500,000	2,500,000	.....	.....	70	150	20	130	150
Coursed Rubble in P. C.	1500	2500	175	250	2,000,000	3,000,000	.....	.....	100	200	20	140	160
Neat P. C.	2000	4000	200	300	1,500,000	3,000,000	1200	2400	400	800	70	80	90	
Neat N. C.	1000	3000	175	250	1,000,000	2,000,000	700	1500	200	400	30	60	70	
P. C. Mortar 1:3	1500	2500	175	250	1,000,000	2,000,000	200	400	35	200	400	120	130	
N. C. Mortar 1:2	800	1500	150	200	800,000	1,500,000	150	300	25	100	200	120	130	
Lime Mortar	200	400	100	150	500,000	800,000	50	100	10	20	40	90	110	
P. C. Stone Concrete 1:2:4	1500	3500	400	500	1,500,000	3,500,000	800	1200	125	200	400	140	150	
N. C. " 1:2:5	1000	2000	200	300	1,000,000	2,000,000	500	1000	80	150	300	140	150	
P. C. Cinder	800	1600	150	200	500,000	1,000,000	70	120	10	100	150	100	110	
Granite	12000	20000	400	600	3,000,000	6,000,000	1200	2400	300	1200	2400	160	180	
Limestone	6000	12000	350	500	2,000,000	5,000,000	1000	2000	175	1000	2000	175	150	
Sandstone	5000	10000	300	400	1,000,000	3,000,000	800	1600	125	800	1600	125	140	
Brick and Tile	2000	5000	200	300	1,000,000	3,000,000	500	1000	80	500	1000	80	120	

ULTIMATE AND SAFE STRENGTH OF IRON AND STEEL IN POUNDS PER SQUARE INCH

Material	Compression			Safe Bearing	Shear			Modulus of Elasticity			Weight per Cu. Ft.
	Ultimate		Safe Average		Ultimate		Safe Average	Ultimate			
	From	To			From	To		From	To		
Hard Steel	36,000	40,000	18,000	26,000	45,000	55,000	12,000	28,000,000	31,000,000	490	
Medium Steel	33,000	38,000	16,000	24,000	50,000	60,000	12,000	"	"	"	
Steel Pins	33,000	38,000	16,000	24,000	50,000	60,000	12,000	"	"	"	
Shop Rivets	24,000	29,000	16,000	24,000	50,000	60,000	12,000	"	"	"	
Field Rivets	24,000	29,000	12,000	20,000	50,000	60,000	10,000	"	"	"	
Cast Steel	60,000	90,000	12,000	26,000	50,000	60,000	12,000	29,000,000	32,000,000	"	
Cast Iron	60,000	90,000	10,000	15,000	15,000	25,000	2,000	12,000,000	18,000,000	450	

Material	Extreme Fiber Stress			Tension			Elastic Limit		Modulus of Resilience
	Ultimate		Safe Average	Ultimate		Safe Average	Ultimate		
	From	To		From	To		From	To	
Hard Steel	50,000	70,000	18,000	65,000	75,000	18,000	35,000	45,000	35
Medium Steel	40,000	60,000	16,000	60,000	70,000	16,000	30,000	40,000	35
Steel Pins	40,000	60,000	24,000	60,000	70,000	16,000	30,000	40,000	
Shop Rivets	40,000	60,000	24,000	48,000	58,000		24,000	30,000	
Field Rivets	40,000	60,000	18,000	46,000	54,000		24,000	30,000	
Cast Steel	60,000	90,000	16,000			18,000	35,000	50,000	
Cast Iron	30,000	40,000	3,500			3,000	10,000	20,000	1.2

PERCENTAGE OF HOOPING FOR VARIOUS CORE DIAMETERS AND HOOPING FOR HOOPED REINFORCED CONCRETE COLUMNS.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

MAXIMUM PITCH OF SPIRALS TO BE NOT GREATER THAN 1/10 THE DIAM. OF COL. NOR GREATER THAN 3"																				Minimum No. of Rods
3/16" Hooping					1/4" Hooping					5/16" Hooping					3/8" Hooping					
Pitch	1 3/8"	1 1/2"	1 5/8"	1 3/4"	2"	1 1/2"	1 5/8"	1 3/4"	1 3/8"	2"	2 1/4"	2 1/2"	1 5/8"	1 3/4"	1 3/8"	2"	2 1/4"	2 1/2"	3"	
9	0.89	0.82	1.46																	
10	0.80	0.74	1.31																	
11	0.73	0.67	1.15																	
12	0.67	0.61	1.09	1.01	0.94	0.87	0.82	1.71	1.57	1.46	1.36	1.27	1.14	1.03					1.46	1.34
13	0.62	0.57	1.01	0.93	0.87	0.81	0.75	1.58	1.45	1.35	1.25	1.17	1.06	0.95				1.50	1.36	1.24
14	0.57	0.53	0.94	0.87	0.81	0.75	0.70	1.46	1.35	1.25	1.17	1.09	0.98	0.88				1.40	1.26	1.15
15	0.54	0.49	0.87	0.81	0.75	0.70	0.65	1.36	1.26	1.17	1.09	1.02	0.91	0.82				1.31	1.17	1.07
16	0.50		0.82	0.76	0.70	0.66	0.61	1.28	1.18	1.10	1.02	0.96	0.85	0.77				1.23	1.11	1.01
17	0.47		0.77	0.71	0.66	0.62	0.58	1.21	1.11	1.03	0.96	0.90	0.81	0.72				1.19	1.03	0.95
18			0.73	0.67	0.63	0.58	0.54	1.14	1.05	0.97	0.91	0.85	0.76	0.68	1.51	1.40	1.31	1.22	1.09	0.98
19			0.69	0.64	0.59	0.55	0.52	1.08	1.00	0.93	0.86	0.81	0.72	0.65	1.43	1.33	1.24	1.16	1.04	0.92
20			0.66	0.61	0.56	0.52	0.49	1.02	0.95	0.88	0.82	0.76	0.68	0.61	1.36	1.26	1.18	1.12	0.98	0.88
21			0.62	0.58	0.54	0.50		0.98	0.90	0.84	0.78	0.73	0.65	0.58	1.30	1.20	1.12	1.05	0.94	0.84
22			0.60	0.55	0.51	0.48		0.93	0.86	0.80	0.75	0.70	0.62	0.56	1.24	1.15	1.07	1.00	0.89	0.80
23			0.57	0.53	0.49			0.89	0.82	0.76	0.71	0.67	0.59	0.53	1.18	1.10	1.02	0.96	0.85	0.77
24			0.55	0.50				0.85	0.79	0.73	0.68	0.64	0.57	0.51	1.13	1.05	0.98	0.92	0.82	0.74
25			0.52	0.49				0.82	0.76	0.70	0.66	0.61	0.55	0.49	1.05	0.97	0.91	0.85	0.76	0.68
26			0.50					0.79	0.73	0.67	0.63	0.59	0.53		1.05	0.97	0.91	0.82	0.73	0.65
27			0.49					0.76	0.70	0.65	0.61	0.57	0.51		1.01	0.94	0.87	0.82	0.70	0.62
28								0.73	0.68	0.63	0.59	0.55	0.49		0.97	0.90	0.84	0.79	0.70	0.62
29								0.71	0.65	0.60	0.57	0.53			0.94	0.87	0.81	0.76	0.68	0.61
30								0.68	0.63	0.58	0.55	0.51			0.91	0.84	0.79	0.73	0.66	0.59
32								0.64	0.59	0.55	0.51	0.48			0.85	0.79	0.74	0.69	0.61	0.55
34								0.60	0.56	0.52	0.48				0.80	0.74	0.69	0.65	0.58	0.52
36								0.57	0.53	0.49					0.76	0.70	0.66	0.61	0.55	0.49
38								0.54	0.50						0.72	0.67	0.62	0.58		
40								0.51	0.47						0.68	0.63	0.59	0.55		
42								0.50							0.65	0.60	0.56	0.53		
44								0.47							0.62	0.57	0.54	0.50		
46															0.59	0.55	0.51	0.48		
48															0.57	0.53	0.49			
50															0.54	0.51				
52															0.52	0.49				
54															0.50					

NOTE: Values inside of heavy lines are within the limits set by the Chicago Building Ordinance. See Sec. 546-567.

Hooping Rods			7/16" Hooping						1/2" Hooping						3/16" Hooping							
Pitch	1 3/4"	1 7/8"	2"	2 1/8"	2 1/4"	2 1/2"	2 3/4"	3"	1 3/8"	1 7/8"	2"	2 1/8"	2 1/4"	2 1/2"	2 3/4"	3"	1 7/8"	2"	2 1/4"	2 1/2"	2 3/4"	3"
16						1.50	1.37	1.25								1.53						6
17					1.57	1.48	1.33	1.22	1.11							1.59	1.45					6
18					1.49	1.40	1.26	1.16	1.05							1.50	1.37					8
19					1.41	1.33	1.29	1.10	1.00							1.57	1.43	1.30				8
20		1.60	1.51	1.43	1.29	1.10	1.00	0.95								1.50	1.36	1.24				8
21		1.53	1.43	1.35	1.27	1.14	1.04	0.95								1.50	1.36	1.24				1.58
22	1.56	1.46	1.37	1.29	1.22	1.09	1.00	0.91					1.59	1.43	1.30	1.18	1.51	1.43	1.30	1.18		1.51
23	1.49	1.39	1.31	1.23	1.16	1.07	0.95	0.87					1.52	1.37	1.24	1.13					1.44	1.44
24	1.43	1.34	1.25	1.18	1.11	1.00	0.91	0.83		1.54	1.45	1.31	1.19	1.09		1.51						1.38
25	1.37	1.28	1.20	1.13	1.07	0.96	0.88	0.80		1.57	1.48	1.40	1.26	1.14	1.04							1.33
26	1.32	1.23	1.16	1.09	1.03	0.93	0.84	0.77		1.51	1.42	1.34	1.21	1.10	1.01					1.53	1.39	1.28
27	1.27	1.19	1.11	1.05	0.99	0.89	0.81	0.74		1.55	1.45	1.37	1.29	1.16	1.06	0.97					1.47	1.34
28	1.23	1.15	1.07	1.01	0.96	0.86	0.77	0.72		1.60	1.50	1.40	1.32	1.25	1.12	1.02	0.93			1.58	1.42	1.29
29	1.18	1.10	1.04	0.98	0.92	0.83	0.75	0.69		1.55	1.44	1.35	1.27	1.20	1.08	0.99	0.90			1.52	1.37	1.25
30	1.14	1.07	1.00	0.94	0.89	0.80	0.73	0.67		1.50	1.40	1.31	1.23	1.16	1.05	0.95	0.87		1.61	1.47	1.32	1.20
31	1.07	1.00	0.95	0.88	0.84	0.75	0.68	0.63		1.40	1.31	1.23	1.15	1.09	0.98	0.89	0.82		1.51	1.38	1.24	1.13
32	1.01	0.94	0.88	0.83	0.79	0.71	0.64	0.59		1.32	1.23	1.15	1.09	1.03	0.92	0.84	0.77	1.56	1.46	1.30	1.17	1.06
33	0.95	0.89	0.83	0.79	0.74	0.67	0.61	0.56		1.25	1.16	1.09	1.02	0.97	0.87	0.79	0.73	1.47	1.38	1.23	1.10	0.92
34	0.90	0.84	0.79	0.75	0.70	0.63	0.58	0.53		1.18	1.10	1.03	0.97	0.92	0.83	0.75	0.69	1.40	1.31	1.16	1.05	0.95
35	0.86	0.80	0.75	0.71	0.67	0.60	0.55	0.50		1.12	1.05	0.98	0.92	0.87	0.79	0.71	0.65	1.32	1.24	1.10	0.99	0.90
36	0.82	0.76	0.72	0.67	0.64	0.57	0.52	0.48		1.07	1.00	0.94	0.88	0.83	0.75	0.68	0.62	1.26	1.18	1.05	0.95	0.86
37	0.78	0.73	0.68	0.64	0.61	0.55	0.50		1.02	0.95	0.89	0.84	0.79	0.71	0.65	0.60	0.55	1.20	1.13	1.00	0.90	0.82
38	0.75	0.70	0.65	0.62	0.59	0.52	0.49		0.98	0.91	0.85	0.80	0.76	0.68	0.62	0.57	0.52	1.15	1.08	0.96	0.87	0.79
39	0.72	0.67	0.63	0.59	0.56	0.50			0.94	0.87	0.82	0.77	0.73	0.65	0.60	0.55	0.50	1.10	1.03	0.92	0.83	0.75
40	0.69	0.64	0.60	0.57	0.54	0.48			0.90	0.84	0.79	0.74	0.70	0.63	0.57	0.52	0.49	1.06	0.99	0.88	0.80	0.72
41	0.66	0.62	0.58	0.54	0.51				0.86	0.80	0.75	0.71	0.67	0.60	0.55	0.50		1.02	0.96	0.85	0.77	0.70
42	0.64	0.59	0.56	0.52	0.49				0.83	0.78	0.73	0.68	0.65	0.58	0.53	0.49		0.98	0.92	0.82	0.74	0.67
43	0.61	0.57	0.54	0.50					0.80	0.75	0.70	0.66	0.62	0.56	0.51			0.95	0.89	0.79	0.71	0.65
44	0.57	0.53	0.50						0.75	0.70	0.65	0.62	0.58	0.52				0.88	0.83	0.77	0.66	0.59

FORMULAS FOR CONCRETE COLUMNS ACCORDING TO THE CHICAGO BUILDING ORDINANCES.

- I. For All Concrete Columns:
 $W = Af$ W = Total safe load in lbs.
 A = Total cross section area of columns in sq. ins. for II.
 f = Total cross section area inside of hooping in sq. ins. for III.
 p = Average allowable unit stress in lbs. per sq. in. (in II and III).
 p' = Percentage of vertical steel (expressed in whole numbers).
 p' = Percentage of hooping steel (expressed in whole numbers).
Maximum height of columns must not exceed $12 \times$ diameter, and no column shall have a cross section area of less than 64 sq. in.
- II. Reinforced Concrete Columns III. Hooped Reinforced Concrete Columns:
1:1:2 Concrete $f = 580$ (1+0.09p)
1:1:2 Concrete $f = 725$ (1+0.25p') (1+0.09p)
1:1 1/2:3 Concrete $f = 480$ (1+0.11p)
1:1 1/2:3 Concrete $f = 600$ (1+30p') (1+0.11p)
1:2:4 Concrete $f = 400$ (1+0.14p)
1:2:4 Concrete $f = 500$ (1+375p') (1+14p)
1:2:4 Concrete $f = 400$ (1+0.14p)
1:2:4 Concrete $f = 500$ (1+375p') (500+70p)

(See Sec. 552 Building Ordinances of Chicago, Ill.)

TABLE I.

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Safe Extreme Fiber Stresses for Reinforced Concrete Beams in Accordance with the Chicago Building Ordinance Requirements for Concrete of Various Mixtures and Various Safe Stresses in the Steel Reinforcement. Straight Line Theory.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

Percentage of tensile reinforcing.	Mixture of concrete. Stone.						Stress in steel.	
	1:1.2.	1:1½:3.	1:2:4.	1:2½:5.	1:3:7.		16000.	18000.
0.00	58	48	40	35	30		0	0
0.01	11	11	11	11	11		9	11
0.02	21	21	21	21	21		19	21
0.03	31	31	31	31	31		28	31
0.04	41	41	41	41	41		37	42
0.05	50	50	50	50	50		45	50
0.06	60	60	60	60	60		55	60
0.07	70	70	70	70	70		65	70
0.08	80	80	80	80	80		70	80
0.09	90	90	90	90	90		80	90
0.10	100	100	100	100	100		90	100
0.11	115	115	115	110	110		100	115
0.12	125	125	125	120	120		110	125
0.13	135	135	135	130	130		120	135
0.14	145	145	145	140	140		125	145
0.15	150	150	150	145	145		135	150
0.16	160	160	160	155	155		145	160
0.17	170	170	170	165	165		150	170
0.18	180	180	180	175	175		160	180
0.19	190	190	190	185	185		170	190
0.20	205	205	205	200	200		180	205
0.22	220	220	220	215	215		195	220
0.24	240	240	240	235	235		210	240
0.26	260	260	260	250	250		230	260
0.28	280	280	275	270	270		245	275
0.30	300	300	295	295	290		265	295
0.32	320	320	315	315	310		280	315
0.34	335	335	330	330	325		295	330
0.36	355	355	350	350	345		310	350
0.38	375	375	370	370	365		330	375
0.40	395	395	390	390	385		345	390
0.42	415	415	410	400	400		365	410
0.44	430	430	425	420	420		380	425
0.46	450	450	445	440	440		395	445
0.48	470	470	465	460	455		410	465
0.50	490	485	480	475	470		430	480
0.52	510	505	500	495	490		445	515
0.54	525	520	515	510	505		460	515
0.56	545	540	535	530	515		480	535
0.58	565	560	555	550	520		495	555
0.60	585	580	575	570	530		510	575
0.62	600	595	590	585	535		525	595
0.64	620	615	610	595	540		540	610
0.66	640	635	630	600	540		560	630
0.68	660	655	650	605	545		575	650
0.70	675	670	665	610	550		590	665
0.72	695	690	680	620	555		605	670
0.74	715	710	685	625	560		620	700
0.76	730	725	690	630	565		635	720
0.78	750	745	695	635	570		655	735
0.80	770	760	700	635	575		670	755
0.82	790	780	710	640	580		685	770
0.84	805	795	715	650	585		700	790
0.86	820	805	720	655	590		715	805
0.88	840	810	725	660	595		730	825
0.90	860	815	730	660	600		750	840
0.92	875	820	735	665	600		765	860

See note on following page.

Percentage of tensile reinforcing.	Mixture of concrete. Stone.						Stress in steel.	
	1:1.2.	1:1½:3.	1:2:4.	1:2½:5.	1:3:7.		16000.	18000.
0.94	895	825	740	670	605		780	875
0.96	920	835	745	675	610		795	895
0.98	930	840	750	680	615		810	910
1.00	950	845	755	685	620		825	930
1.1	980	870	780	700	635		905	1015
1.2	1010	895	800	720	650		980	1105
1.3	1030	920	815	740	660		1055	1190
1.4	1055	940	835	750	680		1135	1275
1.5	1080	960	850	760	690		1205	1360
1.6	1100	980	865	780	695		1285	1445
1.7	1120	995	880	790	710		1355	1530
1.8	1140	1010	895	800	720		1435	1610
1.9	1160	1025	905	810	725		1505	1695
2.0	1175	1040	920	830	740		1580	1780
2.5	1250	1090	965	865	775		1945	2190
3.0	1310	1150	1010	895	800		2305	2590
3.5	1360	1190	1040	925	820		2660	2990
4.0	1405	1220	1070	950	840		3010	3385
4.5	1440	1250	1090	965	860		3355	3770
5.0	1470	1280	1110	980	870		3700	4165

TABLE II.

Ultimate Extreme Fiber Stresses for Concrete Beams Reinforced with High Carbon Steel — Straight Line Theory.

By L. J. MENSCH, Mem. Am. Soc. C. E.

Ultimate Compressive Strength Obtained from Cylinder Tests.

X tensile steel.	Ultimate Compressive Strength Obtained from Cylinder Tests.					
	2900	2400	2000	1750	1500	700
	1:1.2	1:1½:3	1:2:4	1:2½:5	1:3:7	
0.25	1040	1030	1020	1010	1010	960
0.30	1240	1230	1220	1200	1190	1080
0.35	1430	1420	1400	1380	1370	1200
0.40	1630	1610	1580	1560	1550	1330
0.45	1820	1800	1760	1740	1710	1440
0.50	2010	1970	1940	1900	1870	1540
0.55	2190	2150	2110	2060	2030	1620
0.60	2370	2330	2280	2230	2170	1700
0.65	2540	2500	2440	2370	2310	1800
0.70	2720	2650	2600	2520	2450	1800
0.75	2900	2820	2740	2660	2590	1800
0.80	3070	2990	2900	2800	2720	1800
0.85	3240	3150	3040	2930	2830	1800
0.90	3400	3300	3180	3060	2950	1800
0.95	3560	3440	3320	3200	3050	1800
1.00	3700	3570	3450	3310	3160	1800
1.10	4020	3860	3700	3520	3350	1800
1.20	4300	4120	3930	3730	3510	1800
1.30	4600	4380	4140	4000	3600	1800
1.40	4860	4610	4330	4000	3600	1800
1.50	5120	4820	4520	4000	3600	1800
1.60	5370	5050	4600	4000	3600	1800
1.70	5600	5250	4600	4000	3600	1800
1.80	5820	5450	4600	4000	3600	1800
1.90	6040	5600	4600	4000	3600	1800
2.00	6260	5750	4600	4000	3600	1800
2.25	6700	5800	4600	4000	3600	1800

TABLE III.

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Safe Extreme Fiber Stresses in Pounds per Square Inch for Double Reinforced Concrete Beams for Various Percentages of Top and Bottom Steel. Straight Line Theory.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

Maximum Compression on Extreme Fiber of Concrete=700 Lbs. per Sq. In. Maximum Tension in Steel Reinforcement=18000 Lbs. per Sq. In. Mixture of Concrete 1:2:4. Ratio of Modulus of Elasticity of Steel to That of Concrete=15. Ratio of Depth of Top Steel to Depth of Bottom Steel Below Top of Beam=0.10. Values for Other Steel and Concrete Stresses Are Directly Proportionate to Those Given in This Table.

	Percentage of Compressive Steel															
	0.00	0.10	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00		
Percentage of Tensile Steel	0.60	575	578	579	580	581	582	583	584	584	585	586	587	588	589	0.60
	0.62	595	596	597	599	600	601	602	603	604	605	606	607	608	609	0.62
	0.64	610	612	613	615	616	618	619	621	622	624	625	627	628	629	0.64
	0.66	630	632	633	635	636	638	639	641	642	644	645	647	648	649	0.66
	0.68	650	652	653	655	656	658	659	661	662	663	665	666	667	668	0.68
	0.70	665	667	668	670	671	673	674	676	677	678	680	682	684	686	0.70
	0.72	680	688	689	691	693	694	696	697	699	700	702	703	705	706	0.72
	0.74	685	704	706	707	709	710	712	713	715	716	718	719	721	723	0.74
	0.76	690	720	726	728	729	731	732	734	735	737	738	740	741	743	0.76
	0.78	695	726	744	746	747	749	750	752	753	755	757	759	761	763	0.78
	0.80	700	731	762	764	766	768	770	772	774	776	778	780	781	783	0.80
	0.82	710	739	779	782	784	786	788	790	792	794	796	798	800	802	0.82
	0.84	715	743	790	800	802	804	806	808	810	812	814	816	818	821	0.84
	0.86	720	750	795	820	822	824	826	828	830	832	834	836	838	840	0.86
	0.88	725	755	800	839	842	844	846	848	850	852	854	856	858	860	0.88
	0.90	730	760	807	858	861	863	866	868	870	872	874	876	878	880	0.90
	0.92	735	765	812	873	880	883	885	887	890	892	894	896	898	900	0.92
	0.94	740	770	818	888	900	902	904	906	908	910	912	914	916	918	0.94
	0.96	745	775	823	892	920	922	924	926	928	930	932	934	935	937	0.96
	0.98	750	780	828	900	938	940	942	944	946	948	950	952	954	956	0.98
1.00	755	786	832	905	956	958	960	962	964	967	969	972	974	976	1.00	
1.10	780	811	853	930	1010	1060	1061	1063	1065	1066	1068	1069	1071	1072	1.10	
1.20	800	828	874	954	1031	1105	1155	1157	1159	1161	1163	1165	1167	1170	1.20	
1.30	815	850	895	978	1058	1130	1210	1252	1254	1256	1258	1260	1262	1265	1.30	
1.40	835	869	916	1006	1076	1156	1232	1310	1345	1348	1351	1354	1358	1362	1.40	
1.50	850	882	935	1020	1100	1178	1255	1331	1410	1450	1452	1455	1457	1460	1.50	
1.60	865	899	950	1034	1115	1196	1276	1352	1435	1511	1547	1550	1553	1555	1.60	
1.70	880	913	967	1054	1130	1215	1296	1374	1455	1538	1630	1650	1652	1655	1.70	
1.80	895	928	983	1064	1149	1232	1316	1394	1480	1560	1645	1710	1747	1750	1.80	
1.90	905	940	995	1082	1162	1250	1332	1414	1500	1580	1665	1725	1830	1848	1.90	
2.00	920	952	1008	1100	1178	1266	1350	1432	1513	1600	1680	1760	1840	1918	2.00	
2.50	965	1004	1055	1152	1241	1331	1420	1510	1595	1686	1715	1855	1945	2026	2.50	
3.00	1010	1048	1105	1196	1291	1385	1480	1570	1660	1750	1840	1930	2020	2108	3.00	
3.50	1040	1080	1140	1234	1334	1427	1515	1615	1705	1806	1890	1990	2080	2174	3.50	
4.00	1070	1115	1170	1266	1366	1464	1560	1665	1755	1852	1940	2040	2130	2230	4.00	
4.50	1090	1145	1205	1295	1395	1500	1595	1700	1795	1888	1980	2080	2180	2278	4.50	
5.00	1110	1160	1235	1315	1415	1525	1620	1730	1825	1924	2020	2120	2220	2318	5.00	
Percentage of Tensile Steel																

For values above heavy line, tension in steel is equal to 18000 lbs. per square inch.

For values below heavy lines compression in concrete is equal to 700 lbs. per square inch.

Values for other steel and concrete stresses are directly proportional to those given in Tables I and III.

Table I gives the Extreme Fiber Stress for rectangular reinforced concrete beams for various mixtures of concrete and stresses in the steel for percentages of steel varying from plain concrete beams, to beams reinforced with as high as 5% of steel; all in accordance with the Building Ordinance Requirements for the City of Chicago.

In Table II are given in the headings the ultimate compressive strength of concrete as assumed by the Chicago Building Ordinance for various concrete mixtures. According to the theory of Mr. L. J. Mensch as published in the Journal of the American Concrete Institute for December, 1914, these compressive strengths, if introduced in the straight line formula do not agree with scientific tests on reinforced concrete beams to rupture. In order to make the straight line theory agree with the tests at rupture the ultimate extreme fiber stresses as given in Table II must be assumed instead of the values given in the headings.

The value 700 in the heading is for 1:2:4 cinder*-concrete. It is also valid for stone concrete a few days old. The depth of the reinforced concrete beams is of course assumed to be the depth to the center of the steel. Tables I, II and III assume only pure tension or compression failures. Special calculations should therefore be made for bond, shear and diagonal tension.

Table III gives the Extreme Fiber Stress for rectangular Double Reinforced concrete beams, for various percentages of tensile and compressive steel; all in accordance with the Building Ordinance Requirements for the City of Chicago. See Sec. 546-567

RECOMMENDATIONS FOR THE DESIGN OF HOPPED COLUMNS.

Concrete 1:2:4.
 Rods round— $1\frac{1}{2}$ " to $1\frac{1}{4}$ ".
 Core diameter $4\frac{1}{2}$ " less than column diameter.
 As few different sizes of columns as possible.
 Column diameter never less than $1\frac{1}{12}$ th the story height.
 Percentage of vertical steel from $1\frac{1}{2}$ to 7.
 Percentage of hooping steel from 0.5% to 1.5%.
 Maximum pitch of spiral $1\frac{1}{10}$ th of core diameter, or 3".
 Minimum pitch of spiral $1\frac{1}{2}$ ".
 Maximum size of spiral steel $1\frac{1}{2}$ ".
 Minimum size of spiral steel 3 16".
 Maximum spacing of vertical steel 3" or $\frac{1}{8}$ circumference of column.
 Minimum spacing of vertical steel $3\frac{1}{2}$ ".
 Minimum lap of vertical steel 18".
 Lap of vertical steel for average core stresses less than $10000\frac{1}{r}$ "—25 diameters.

Lap of vertical steel for average core stresses greater than $10000\frac{1}{r}$ "—30 diameters.
 Length of plain round stub bars in footings, 60 diameters.
 Length of square twisted stub bars in footings, 40 diameters.
 Stub bars embedded one-half their length in footing and one-half in column.
 Length of spirals to be clear story height with one extra turn at top and bottom.
 3 vertical lines of spacers for all spirals under 18" diameter.
 4 vertical lines of spacers for all spirals over 18" diameter.
 When columns require a large percentage of vertical steel it is often more economical to use a structural steel column and encase it in concrete. It must be remembered that the working stress of reinforcing steel is only (max) while that of a structural column encased in concrete is $18000\frac{1}{r}$.

Metric Tables.

	Approximate Equivalent.		Accurate Equivalent.
1 inch	[length]... $2\frac{1}{2}$	cubic centimeters	2.539
1 centimeter	0.4	inch	0.393
1 yard	1	meter	0.914
1 meter (39.37 inches)	1	yard	1.093
1 foot	30	centimeters	30.479
1 kilometer (1,000 meters)	5	mile	0.621
1 mile	$1\frac{1}{2}$	kilometers	1.600
1 gramme	[weight]... $15\frac{1}{2}$	grains	15.432
1 grain	0.064	gramme	0.064
1 kilogramme (1,000 grammes)	2.2	pounds avoirdupois	2.204
1 pound avoirdupois	$\frac{1}{2}$	kilogramme	0.453
1 ounce avoirdupois (437 $\frac{1}{2}$ grains)	28 1 3	grammes	28.349
1 ounce troy, or apothecary (480 grains)	31	grammes	31.103
1 cubic centimeter	[bulk]... 1.06	cubic inch	1.060
1 cubic inch	16 1 3	cubic centimeters	16.386
1 liter (1,000 cubic centimeters)	1	U. S. standard quart	0.946
1 United States quart	1	liter	1.057
1 fluid ounce	29 1 2	cubic centimeters	29.570
1 hectare (10,000 square meters)	[surface]... $2\frac{1}{2}$	acres	2.471
1 acre	0.4	hectare	0.40

In the nickel five-cent piece of our coinage is a key to the tables of linear measures and weights. The diameter of this coin is two centimeters, and its weight is five grammes. Five of them placed in a row will give the length of the decimeter, and two of them will weigh a decagram. As the kiloliter is a cubic meter, the key to the measure of length is also the key to the measure of capacity.

Handy Table.

Diameter of a circle $\times 3.1416$ = circumference.	Circumference of a sphere \times its diameter = surface.
Radius of a circle $\times 6.283185$ = circumference.	Square of the diameter of a sphere $\times 3.1416$ = surface.
Square of the diameter of a circle $\times 0.7854$ = area.	Square of the circumference of a sphere $\times 0.3183$ = surface.
Square of the circumference of a circle $\times 0.07958$ = area.	Cube of the diameter of a sphere $\times 0.5236$ = solidity.
Half the circumference of a circle \times half its diameter = area.	Cube of the radius of a sphere $\times 4.1888$ = solidity.
Circumference of a circle $\times 0.159155$ = radius.	Cube of the circumference of a sphere $\times 0.016887$ = solidity.
Square root of the area of a circle $\times 0.56419$ = radius.	Square root of the surface of a sphere $\times 0.56419$ = diameter.
Circumference of a circle $\times 0.31831$ = diameter.	Square root of the surface of a sphere $\times 1.772454$ = circumference.
Square root of the area of a circle $\times 1.12838$ = diameter.	Square root of the solidity of a sphere $\times 1.2407$ = diameter.
Diameter of a circle $\times 0.866$ = side of inscribed equilateral triangle.	Cube root of the solidity of a sphere $\times 3.8978$ = circumference.
Diameter of a circle $\times 0.7071$ = side of an inscribed square.	Radius of 1 sphere $\times 1.1547$ = side of inscribed cube.
Circumference of a circle $\times 0.225$ = side of an inscribed square.	Square root of (1/4 of the square of) the diameter of a sphere = side of inscribed cube.
Circumference of a circle $\times 0.282$ = side of an equal square.	Area of its base $\times \frac{1}{3}$ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.
Diameter of a circle $\times 0.8862$ = side of an equal square.	Area of one of its sides $\times 6$ = surface of a cube.
Base of a triangle $\times \frac{1}{2}$ the altitude = area.	Altitude of trapezoid $\times \frac{1}{2}$ the sum of its parallel sides = area.
Sum of two diameters and 0.7854 together = area of an ellipse.	
Solidity of a sphere $\div 1.6$ of its diameter = solidity.	

Square root of ($\frac{1}{6}$ of the square of) the diameter of a sphere = side of inscribed cube.
 Area of its base $\times \frac{1}{3}$ of its altitude = solidity of a cone or pyramid, whether round,
 square, or triangular.

Area of one of its sides $\times 6$ = surface of a cube.

Altitude of trapezoid $\times \frac{1}{2}$ the sum of its parallel sides = area.

TABLE OF SQUARE ROOTS.

No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root
25	5.	650	25.46	1400	37.42	2600	50.99
50	7.071	700	26.46	1450	38.08	2700	51.96
75	8.66	750	27.39	1500	38.73	2800	52.91
100	10.00	800	28.28	1550	39.37	2900	53.85
125	11.18	850	29.15	1600	40.00	3000	54.77
150	12.25	900	30.00	1650	40.62	3200	56.57
175	13.23	950	30.82	1700	41.23	3400	58.30
200	14.14	1000	31.62	1800	42.43	3600	60.00
250	15.81	1050	32.40	1900	43.59	3800	61.64
300	17.32	1100	33.16	2000	44.72	4000	63.24
350	18.70	1150	33.91	2100	45.82	4200	64.80
400	20.00	1200	34.64	2200	46.90	4400	66.32
450	21.21	1250	35.36	2300	47.95	4600	67.82
500	22.36	1300	36.06	2400	48.99	4800	69.28
550	23.45	1350	36.74	2500	50.00	5000	70.72
600	24.49						

Dimensions of a Barrel.—Diameter of head, 17 inches; bung, 19 inches; length, 28 inches; volume, 7,680 cubic inches.

Expansion of Water (Dalton).

Temperature.	Expansion.	Temperature.	Expansion.	Temperature.	Expansion.
22°	1.0009	72°	1.0018	152°	1.01934
32	1	92	1.00477	172	1.02575
*46	1	112	1.0088	192	1.03265
52	1.00021	132	1.01367	212	1.0466

*Greatest density at 39.1° Fahr.

A box 24 inches long by 16 inches wide and 28 inches deep will contain a barrel, or three bushels; 24 by 16 inches and 14 inches deep contains half a barrel; 16 inches square and 8 $\frac{1}{2}$ inches deep will contain one bushel; 16 by 8 $\frac{1}{2}$ inches and 8 inches deep will contain half a bushel; 8 by 8 $\frac{1}{2}$ inches and 8 inches deep will contain one peck; 8 inches square and 4 $\frac{1}{2}$ inches deep will contain one gallon; 7 by 4 inches and 4 $\frac{1}{2}$ inches deep will contain half a gallon; 4 inches square and 4 $\frac{1}{2}$ inches deep will contain one quart; 4 feet long, 3 feet 5 inches wide and 2 feet 8 inches deep will contain one ton of coal, or 36 cubic feet.

Table Showing the Pressure of Water at Different Elevations.

Feet Head	Equals Pressure per Square Inch.	Feet Head	Equals Pressure per Square Inch	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch
1	43	65	28.15	130	56.31	195	84.47	260	112.62	350	151.61
5	2.16	70	30.32	135	58.45	200	86.63	265	114.79	360	155.94
10	4.33	75	32.48	140	60.64	205	88.80	270	116.96	370	160.27
15	6.49	80	34.65	145	62.81	210	90.96	275	119.12	380	164.61
20	8.66	85	36.82	150	64.97	215	93.14	280	121.29	390	168.94
25	10.82	90	38.98	155	67.14	220	95.30	285	123.45	400	173.27
30	12.99	95	41.15	160	69.31	225	97.49	290	125.62	500	216.58
35	15.16	100	43.31	165	71.47	230	99.63	295	127.78	600	259.90
40	17.32	105	45.48	170	73.64	235	101.79	300	129.95	700	303.22
45	19.49	110	47.64	175	75.80	240	103.96	310	134.28	800	346.54
50	21.65	115	49.81	180	77.97	245	106.13	320	138.62	900	389.86
55	23.82	120	51.98	185	80.14	250	108.29	330	142.95	1,000	433.18
60	25.99	125	54.15	190	82.30	255	110.46	340	147.28		

**Weights of Materials.
Dry Woods.**

	Lbs. Board ft.	Lbs Cubic ft.		Lbs. Board ft	Lbs. Cubic ft.
Apple	4.1	49.	Iron Wood	6.	71.
Ash, American, white	3.9	47.	Larch	3.	35.
Birch	3.9	45.	Lignum Vitæ	6.9	83.
Beech	3.7	43.	Mahogany, Honduras	2.9	35.
Boxwood	5.	60.	Mahogany, Spanish	4.1	53.
Cedar, American	2.9	35.	Maple	4.1	49.
Cedar, W. Indian	3.9	47.	Maple, soft	3.5	42.
Cedar, Lebanon	2.5	30.	Oak, live	4.9	59.3
Cherry	3.5	42.	Oak, red	3.9	45.
Chestnut	3.1	41.	Oak, white	4.3	52.
Cork	1.3	15.	Pine, Southern	3.7	45.
Elm	2.9	35.	Pine, white	2.1	25.
Ebony	6.3	76.1	Pine, yellow	2.8	34.3
Hemlock	2.1	25.	Spruce	2.1	25.
Hickory	4.4	53.	Sycamore	3.1	37.
Hornbeam	2.9	47.	Walnut	3.2	38.

Building Materials—Stacked.

	Lbs. per cubic ft.		Lbs. per cubic ft.
Brick—pressed	150	Glass—window	157
" common	125	Granite	170
" soft	100	Lime—quick	53
Cement—Portland	100	Plaster of Paris	70
Cement—Rosendale	56	Sand	90-106
Cinders—dry	72	Sandstone	151
Cinders—packed	90	Shale	162
Earth—dry, shaken	82- 92	Slate	175
Earth—rammed	92-100	Trap rock	187

Masonry.

	Lbs. per cubic ft.		Lbs. per cubic ft.
Brick—pressed or paving	140	Granite	160
Brick—hard, common	120	Mortar and plaster	120
Brick—soft	100	Rubble—limestone, common	140
Brick—hollow	90	Rubble—limestone, cut face	150
Concrete—stone	150	Rubble—sandstone, common	140
Concrete—cinder	96	Rubble—sandstone, cut face	150

Building Materials—In Construction.

Roofing.

	Lbs. per square ft.		Lbs. per square ft.
Copper—sheet	0.75 to 1.25	Shingles—wood 16"	2
Felt and gravel	.8 to 10	Singles—wood 16"	2
Iron—corrugated	.1 to 3.75	Slate—average	10
Iron—galvanized	.1 to 3	Tile—fancy, laid in mortar	25 to 30
Iron sheet, black, painted	.1.5	Tile—plain, average	12
Ready composition roofing	.1 to 1.5	Tin and paint	1
Sheet lead	.1 to 8	Zinc	1 to 2

Floors.

	Lbs. per sq. ft.		Lbs. per sq. ft.
Flat arches (tile) 3" thick	17	Flat arches (tile) 12" thick	39
" " " 4" "	18	" " " 14" "	43
" " " 6" "	25	" " " 16" "	49
" " " 8" "	31	Book tile 2" thick	15
" " " 10" "	35	" " 3" "	17
Brick arches 1" thick and concrete	70	Beam tile	15

Joists and Rafters.

			lbs. per sq. ft.				lbs. per sq. ft.
Inches.		centers.		Inches.		centers.	
White pine	2x 4—12		1.1	Yellow pine	2x 4—12		1.9
"	2x 4—14		1.3	"	2x 4—14		2.2
"	2x 4—16		1.5	"	2x 4—16		2.5
"	2x 6—12		1.7	"	2x 6—12		2.8
"	2x 6—14		2.0	"	2x 6—14		3.3
"	2x 6—16		2.25	"	2x 6—16		3.75
"	2x 8—12		2.25	"	2x 8—12		3.75
"	2x 8—14		2.6	"	2x 8—14		4.4
"	2x 8—16		3	"	2x 8—16		5
"	2x10—12		2.8	"	2x10—12		4.7
"	2x10—14		3.3	"	2x10—14		5.5
"	2x10—16		3.75	"	2x10—16		6.25
"	2x12—12		3.4	"	2x12—12		5.6
"	2x12—14		4	"	2x12—14		6.6
"	2x12—16		4.5	"	2x12—16		7.5

Partitions.

			lbs. per sq. ft.				lbs. per sq. ft.
Gypsum partition blocks	3" thick.		10	Partition tile	3" thick.		17
"	" 4" "		12	"	4" "		18
"	" 5" "		14	"	6" "		25
"	" 6" "		16	"	8" "		31
Plaster on brick, tile or concrete.			5	"	10" "		35

Ceiling.

	lbs. per sq. ft.
Lath and plaster 2 coats.	9
Lath and plaster 3 coats.	10
Suspended ceiling	10

Sheathing, Flooring, etc.

	lbs. per sq. ft.
Pine, Hemlock, Spruce, Poplar, Red-wood, per inch thick.	3
Chestnut, Maple	4

Weight per Square Foot of Sheet Lead.

	lbs.		lbs.
1/62 inch thick.	2	1 10 inch thick.	7
3/64 " "	2 1/2	1 8 " "	8
1/25 " "	3	5 3/32 " "	10
1/16 " "	4	3 16 " "	12
1/14 " "	5	7 3/32 " "	14
1/12 " "	6	1 1/4 " "	16

Miscellaneous Items.

While the following items vary considerably in weight, the values given below are fair averages and may be used for preliminary computations.

	lbs. per sq. ft.
Iron stair construction	50
Concrete stair construction	150

	lbs. per sq. ft.
Wood stair construction	20
Sidewalk lights in concrete	30
Reinforcement of concrete	6
Steel joists per sq. ft. of floor.	6
Steel girders per sq. ft. of floor.	4

Contents of Storage Warehouses.

Material.	Weight per Cu. ft.	Allowable Height of Pile in ft.	Material.	Weight per Cu. ft.	Allowable Height of Pile in ft.
Groceries Etc.			Wool—worsted, in cases..	27	8
Beans—in bags	40	8	Hardware, Etc.		
Canned goods—cases	58	6	Sheet tin—in boxes.	278	2
Coffee—roasted, in bags.	33	8	Wire—insulated copper, in coils	63	5
Coffee—green, in bags.	39	8	Wire—galvanized iron, in coils	74	4.5
Flour—in barrels	40	5	Wire—magnet, on spools.	75	6
Molasses—in barrels	48	5	Drugs, Paints, Oils, Etc.		
Rice—in bags	58	6	Glycerine—in cases.	52	6
Sal Soda—in barrels	46	5	Linseed oil—in bbls.	36	6
Salt—in bags	70	5	Logwood extract—in boxes	70	5
Soap powder—in cases.	38	8	Rosin—in bbls.	48	6
Starch—in barrels	25	6	Shellac—gum	38	6
Sugar—in barrels	43	5	Soda—Caustic, in iron drums	88	3.33
Sugar—in cases	51	6	Soda—Silicate, in bbls.	53	6
Tea—in chests	25	8	Sulphuric Acid	60	1.66
Wines and Liquors, in bbls.	38	6	White Lead Paste—in cans	174	3.5
			White Lead—dry	86	4.75
Dry Goods, Cotton, Wool, Etc.			Red Lead and Litharge		
Burlap—in bales	43	6	Putty—dry	132	3.75
Coir Yarn, in bales.	33	8	Miscellaneous.		
Cotton—in bales, compressed	18	8	Glass and Chinaware—in cases	10	8
Cotton Bleached Goods—in cases	28	8	Hides and Leather—in bales	20	8
Cotton Flannel—in cases.	12	8	Paper—in newspaper and strawboard	35	6
Cotton Sheeting—in cases.	23	8	Paper—writing and calendar	60	6
Cotton Yarn—in cases.	25	8	Rope—in coils	32	6
Excelsior—compressed	19	8			
Hemp—Manila, compressed	30	8			
Linon Goods—in cases.	30	8			
Wool—in bales, not compressed	13	8			

NOMENCLATURE OF DRAWINGS

We present in the following pages a collection of symbols for plan nomenclature, which we hope will be the means of bringing about a more uniform practice. In addition to the convenience, which will result from uniform practice to those compelled to examine estimates from or execute plans from different offices; it will be found that the proficiency of draftsmen will not be so seriously affected on changing from office to office if practice becomes uniform.

General symbols presented have been collected from various sources. To assist memory, those symbols have been selected which are suggestive in their make up.

GENERAL SYMBOLS

	In color system	Use
	Black	Earth
	Green	Cinders
	Brown	Concrete
	Blue	Stone
	Red	Brick
	Brown	Structural tile
	Blue	Composition wall blocks
	Brown	Architectural terra cotta
	Blue	Plaster
	Green	Structural iron
	Green	Sheet metal
	Brown	Floor tile, tile and mosaics
	Blue	Marble in elevation
	Blue	Marble in section
	Black	Terrazzo
	Yellow	Wood in section - soft wood
	Brown	Wood in section - hard wood
	Yellow	Wood in section - soft wood
	Brown	Wood in section - hard wood
	Brown	Luck
	Blue	Glass

		Dressed ashlar
		Red faced ashlar
		Any stone dressed
		Not described - small numeral refers to details and specifications

For illustration all lines indicating water pipes have a periodic double indentation suggestive of a "W"; gas lines a periodic embryo "G", etc.

Lighting symbols are those adopted by the American Institute of Architects and the National Electrical Contractors' Association, except that 50 watts is taken as the standard for one light unit instead of 16 c. p.

Structural iron standard symbols; the Osborn systems are so generally understood and used that it hardly seems necessary to publish same. (See Cambria pocket book, 1906 edition, p. 309.)

	Column - Small numeral indicates No. of particular column
	Door - Small numeral indicates No. of particular door
	Window - Small numeral indicates No. of particular window
	Indicates designating No. of a room or space.
	Elevation of point, small numerals indicate elevation above zero point.

PIPING SYMBOLS






















	In color system
	Cold water ... Blue
	Hot water ... Red
	Hot water return ... Red
	Filtered or drinking water ... Blue
	Gas piping ... Green
	Air piping ... Green
	Compressed air piping ... Green
	Vacuum cleaning ... Green

SEWERAGE AND DRAINAGE

	Iron sewer pipe ... Green
	Sanitary iron sewer pipe ... Green
	Tile sewer ... Red
	Sanitary Tile Sewer ... Red
	Drainage tile ... Brown

	Soil pipe ... Green
	Waste pipe ... Green
	Down spout ... Green
	Vent riser ... Green

	Floor drain ... Brown
	Bracket - Prefix with "F" if for fuel ... Blue
	Ceiling - Prefix with "F" if for fuel ... Blue
	Floor outlet - Prefix with "F" if for fuel ... Blue
	Combined gas and electric, lower figure indicates No. of gas tips, upper figure indicates No. of 50 watt electric lamps ... Blue

	Ceiling outlet, electric only. No. in center indicates No. of standard 50 watt electric lamps		Main or feeder run under floor concealed
	Ceiling outlet, combination 4 2 indicates 200 watt electric light capacity and 2 gas burners		Main or feeder run concealed under floor above
	Bracket outlet, electric only. Numeral in center indicates No. 50 watt electric lamps		Main or feeder run exposed
	Bracket outlet, combination 4 2 indicates 200 watt electric light capacity and 2 gas burners		Branch circuit run concealed under floor
	Wall or baseboard receptacle outlet. Numeral in center indicates No. of stand. 50 watt electric lamps		Branch circuit run concealed under floor above
	Floor outlet. Numeral in center indicates number of 50 watt electric lamps		Branch circuit run exposed
	Outlet for outdoor standard or pedestal, electric only. Numeral indicates No. of 50 watt electric lamps		Pole line
	Outlet for outdoor standard or pedestal. Combination 6 6 indicates 300 watt electric light capacity lamps, 6 gas burners		Riser
	Special outlet for lighting, heating or power current as described in specifications		Telephone outlet, Private service
	Drop cord outlet		Telephone outlet, Public service
	One light outlet for lamp receptacle		Bell outlet
	Arc lamp outlet		Buzzer outlet
	Ceiling fan outlet		Push button outlet. Numeral indicates No. of pushes
	S P Switch outlet.		Annunciator, Numeral indicates No. of points
	D P Switch outlet		Speaking tube
	Tway switch outlet		Watchman clock outlet
	Automatic door switch outlet		Watchman station outlet
	Electrolier switch outlet		Master time clock outlet
	Meter outlet		Secondary time clock outlet
	Distribution panel		Door opener
	Junction or pull box		Special outlet, signal system as described in specifications
	Motor outlet. Numeral in center indicates horse power		Battery outlet
	Motor control outlet		
	Transformer		
	Current for clock, telephone, bell or other service run under floor concealed. Kind of service wanted ascertained by symbol to which line connects		
	Current for clock, telephone, bell or other service run under floor above, concealed. Kind of service wanted ascertained by symbol to which line connects		

NOTE. If other than standard 50 watt electric lamps capacity is desired specifications should describe capacity of lamp desired.

SUGGESTIONS IN CONNECTION WITH STANDARD SYMBOLS FOR WIRING PLANS.

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

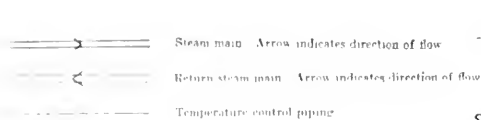
It is desirable that a key to the symbols used accompany all plans.

If mains, feeders, branches and distribution panels are shown on the plans it is desirable that they be designated by letters or numbers.

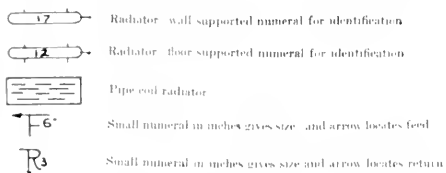
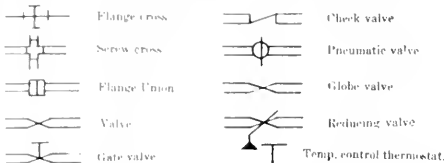
Heights of center of wall outlets, unless otherwise specified:

Living rooms	5' 6"
Chambers	5' 0"
Offices	6' 0"
Corridors	6' 3"

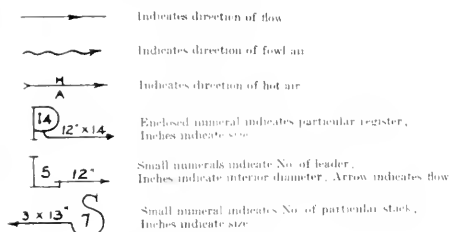
Heights of Switches unless otherwise specified: 4' 0"



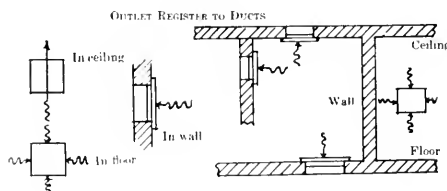
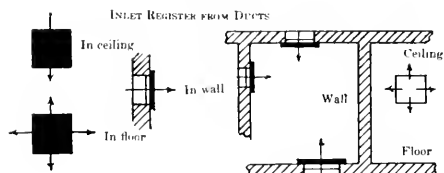
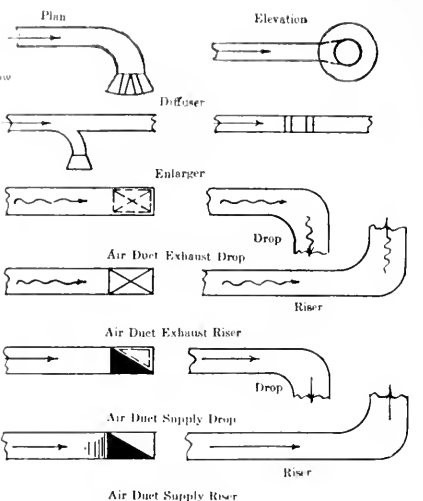
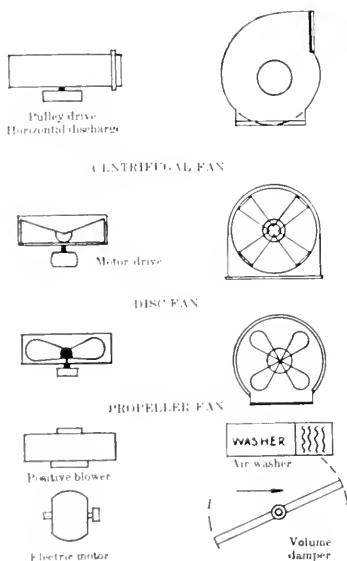
- S F 7 Steam feed vertical—No. designates particular pipe
- S R 5 Steam return vertical—No. designates particular pipe



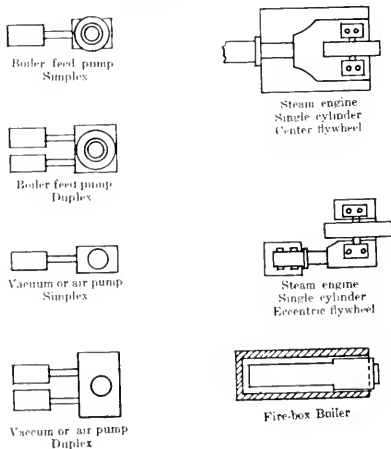
VENTILATING SYMBOLS



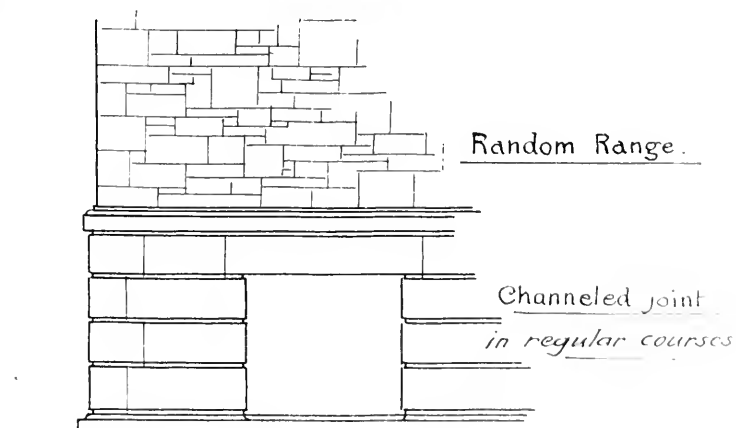
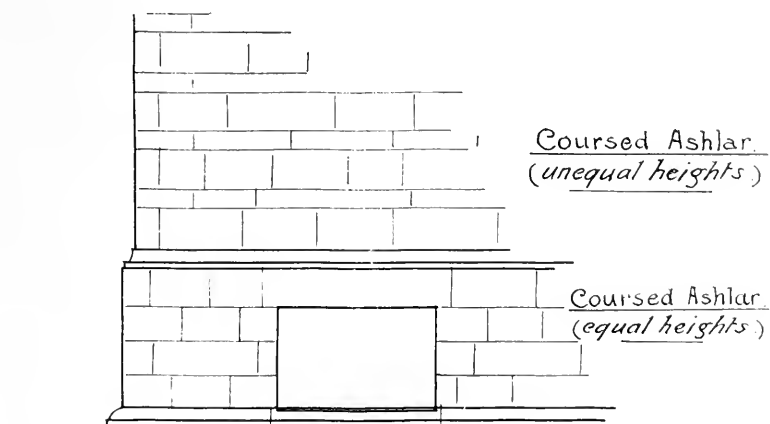
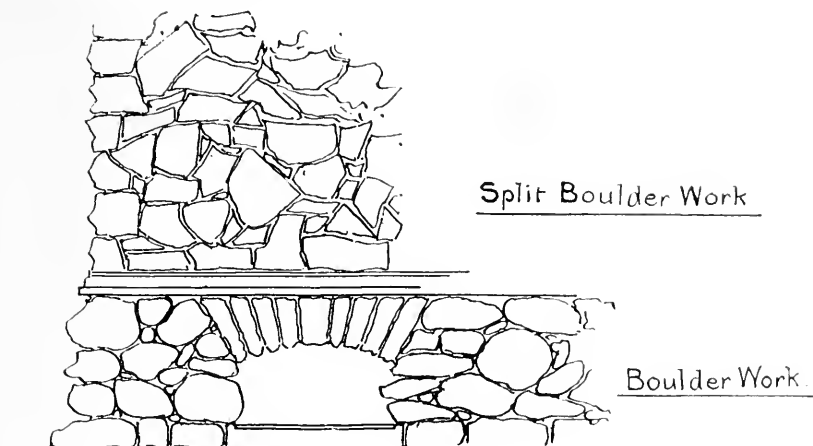
MECHANICAL EQUIPMENT



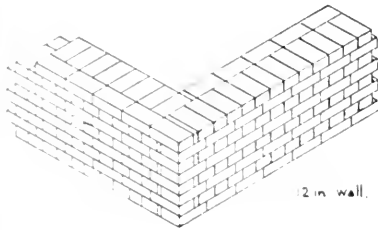
MECHANICAL EQUIPMENT



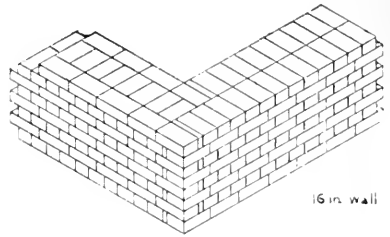
Suggestions for Setting Stone.



Bonds Used in Laying Brickwork.



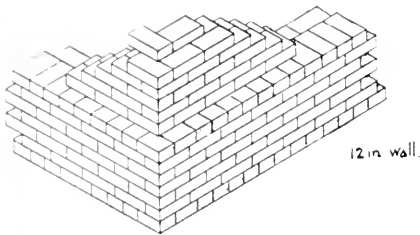
12 in. wall.



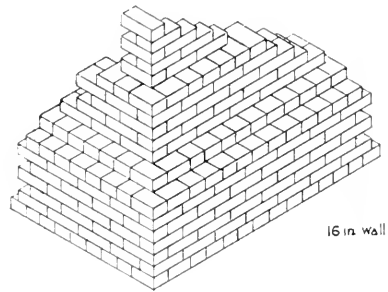
16 in. wall.

English Bond.

One row of headers and one of stretchers in alternate courses.



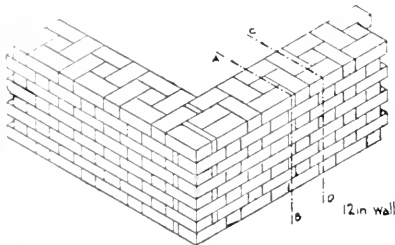
12 in. wall.



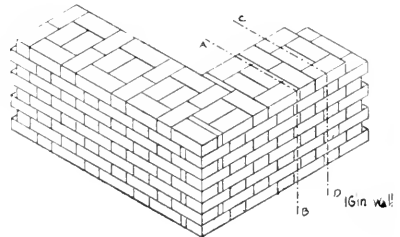
16 in. wall.

Chicago Bond.

One row of headers and five courses of stretchers.



12 in. wall.



16 in. wall.

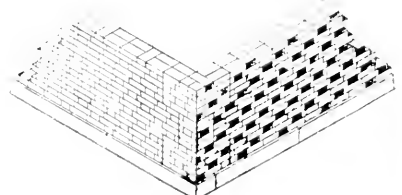
Flemish Bond.

Headers and stretchers alternating in each course.



English Garden Wall Bond.

Three stretchers and one header alternating in each course.



German Cross Bond.

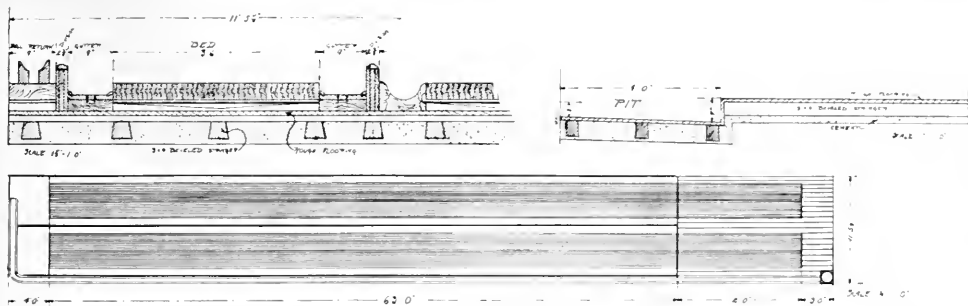
Two stretchers and one header alternating in each course.

TABLE OF TREADS AND RISES.

No. of Treads	6	6 ¹ / ₂	6 ² / ₅	6 ³ / ₄	7	7 ¹ / ₂	7 ² / ₅	7 ³ / ₄	7 ⁴ / ₅	7 ⁵ / ₄	7 ⁶ / ₅	7 ⁷ / ₄	8	8 ¹ / ₂	8 ² / ₅	9	9 ¹ / ₂	10	10 ¹ / ₂	11	13	14
	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.	Inch Rise ft.
1	6	6 ¹ / ₂	6 ² / ₅	6 ³ / ₄	7	7 ¹ / ₂	7 ² / ₅	7 ³ / ₄	7 ⁴ / ₅	7 ⁵ / ₄	7 ⁶ / ₅	7 ⁷ / ₄	8	8 ¹ / ₂	8 ² / ₅	9	9 ¹ / ₂	10	10 ¹ / ₂	11	13	14
2	1 0	1 0 ¹ / ₂	1 1	1 1 ¹ / ₂	1 2	1 2 ¹ / ₂	1 3	1 3 ¹ / ₂	1 3 ² / ₅	1 3 ³ / ₄	1 3 ⁴ / ₅	1 3 ⁵ / ₄	1 4	1 4 ¹ / ₂	1 5	1 6	1 7	1 8	1 9	1 10	2 2	2 4
3	1 6	1 6 ¹ / ₂	1 7 ¹ / ₂	1 8 ¹ / ₂	1 9	1 9 ¹ / ₂	1 10 ¹ / ₂	1 10 ² / ₅	1 10 ³ / ₄	1 11 ¹ / ₂	1 11 ² / ₅	1 11 ³ / ₄	2 0	2 0 ¹ / ₂	2 1 ¹ / ₂	2 3	2 4 ¹ / ₂	2 6	2 7 ¹ / ₂	2 9	3 3	3 6
4	2 0	2 1	2 2	2 3	2 4	2 4 ¹ / ₂	2 5	2 5 ¹ / ₂	2 6	2 6 ¹ / ₂	2 7	2 7 ¹ / ₂	2 8	2 9	2 10	3 0	3 2	3 4	3 6	3 8	4 4	4 8
5	2 6	2 7 ¹ / ₂	2 8 ¹ / ₂	2 9 ¹ / ₂	2 11	2 11 ¹ / ₂	3 0 ¹ / ₂	3 0 ² / ₅	3 1 ¹ / ₂	3 2 ¹ / ₅	3 2 ² / ₅	3 2 ³ / ₄	3 4	3 5 ¹ / ₂	3 6 ¹ / ₂	3 9	3 11 ¹ / ₂	4 2	4 4 ¹ / ₂	4 7	5 5	5 10
6	3 0	3 1 ¹ / ₂	3 3	3 4 ¹ / ₂	3 6	3 6 ¹ / ₂	3 7 ¹ / ₂	3 8 ¹ / ₂	3 9	3 9 ¹ / ₂	3 10 ¹ / ₂	3 11 ¹ / ₂	4 0	4 1 ¹ / ₂	4 3	4 6	4 9	5 0	5 3	5 6	6 6	7 0
7	3 6	3 7 ¹ / ₂	3 9 ¹ / ₂	3 11 ¹ / ₂	4 1	4 1 ¹ / ₂	4 2 ¹ / ₂	4 3 ¹ / ₂	4 4 ¹ / ₂	4 5 ¹ / ₂	4 6 ¹ / ₂	4 7 ¹ / ₂	4 8	4 9 ¹ / ₂	4 11 ¹ / ₂	5 3	5 6 ¹ / ₂	5 10	6 1 ¹ / ₂	6 5	7 7	8 2
8	4 0	4 2	4 4	4 6	4 8	4 9	4 10	4 11	5 0	5 1	5 2	5 3	5 4	5 6	5 8	6 0	6 4	6 8	7 0	7 4	8 8	9 4
9	4 6	4 8 ¹ / ₂	4 10 ¹ / ₂	5 0 ¹ / ₂	5 3	5 4 ¹ / ₂	5 5 ¹ / ₂	5 6 ¹ / ₂	5 7 ¹ / ₂	5 8 ¹ / ₂	5 9 ¹ / ₂	5 10 ¹ / ₂	6 0	6 2 ¹ / ₂	6 4 ¹ / ₂	6 9	7 1 ¹ / ₂	7 6	7 10 ¹ / ₂	8 3	9 9	10 6
10	5 0	5 2 ¹ / ₂	5 5	5 7 ¹ / ₂	5 10	5 11 ¹ / ₂	6 0 ¹ / ₂	6 1 ¹ / ₂	6 3	6 4 ¹ / ₂	6 5 ¹ / ₂	6 6 ¹ / ₂	6 8	6 10 ¹ / ₂	7 1	7 6	7 11	8 4	8 9	9 2	10 10	11 8
11	5 6	5 8 ¹ / ₂	5 11 ¹ / ₂	6 2 ¹ / ₂	6 5	6 6 ¹ / ₂	6 7 ¹ / ₂	6 8 ¹ / ₂	6 10 ¹ / ₂	6 11 ¹ / ₂	7 1 ¹ / ₂	7 2 ¹ / ₂	7 4	7 6 ¹ / ₂	7 9 ¹ / ₂	8 3	8 8 ¹ / ₂	9 2	9 7 ¹ / ₂	10 1	11 11	12 10
12	6 0	6 3	6 6	6 9	7 0	7 1 ¹ / ₂	7 2 ¹ / ₂	7 3 ¹ / ₂	7 4 ¹ / ₂	7 5 ¹ / ₂	7 6 ¹ / ₂	7 7 ¹ / ₂	7 8	8 0	8 3	8 6	9 0	10 0	10 6	11 0	13 0	14 0
13	6 6	6 9 ¹ / ₂	7 0 ¹ / ₂	7 3 ¹ / ₂	7 7	7 8 ¹ / ₂	7 10 ¹ / ₂	7 11 ¹ / ₂	8 1 ¹ / ₂	8 2 ¹ / ₂	8 3 ¹ / ₂	8 4 ¹ / ₂	8 8	8 11 ¹ / ₂	9 2 ¹ / ₂	9 9	10 3 ¹ / ₂	10 10	11 4 ¹ / ₂	11 11	14 1	15 2
14	7 0	7 3 ¹ / ₂	7 7	7 10 ¹ / ₂	8 2	8 3 ¹ / ₂	8 5 ¹ / ₂	8 7 ¹ / ₂	8 9	8 10 ¹ / ₂	9 0 ¹ / ₂	9 2 ¹ / ₂	9 4	9 7 ¹ / ₂	9 11	10 6	11 1	11 8	12 3	12 10	15 2	16 4
15	7 6	7 10 ¹ / ₂	8 1 ¹ / ₂	8 5 ¹ / ₂	8 9	8 10 ¹ / ₂	9 0 ¹ / ₂	9 2 ¹ / ₂	9 4 ¹ / ₂	9 6 ¹ / ₂	9 8 ¹ / ₂	9 10 ¹ / ₂	10 0	10 3 ¹ / ₂	10 7 ¹ / ₂	11 3	11 10 ¹ / ₂	12 6	13 1 ¹ / ₂	13 9	16 3	17 6
16	8 0	8 4	8 8	9 0	9 4	9 6	9 8	9 10	10 0	10 2	10 4	10 6	10 8	11 0	11 4	12 0	12 8	13 4	14 0	14 8	17 4	18 8
17	8 6	8 10 ¹ / ₂	9 2 ¹ / ₂	9 6 ¹ / ₂	9 11	10 1 ¹ / ₂	10 3 ¹ / ₂	10 5 ¹ / ₂	10 7 ¹ / ₂	10 9 ¹ / ₂	10 11 ¹ / ₂	11 1 ¹ / ₂	11 4	11 8 ¹ / ₂	12 0 ¹ / ₂	12 9	13 5 ¹ / ₂	14 2	14 10 ¹ / ₂	15 7	18 6	19 10
18	9 0	9 4 ¹ / ₂	9 9	10 1 ¹ / ₂	10 6	10 8 ¹ / ₂	10 10 ¹ / ₂	11 0 ¹ / ₂	11 3	11 5 ¹ / ₂	11 7 ¹ / ₂	11 9 ¹ / ₂	12 0	12 4 ¹ / ₂	12 9	13 6	14 3	15 0	15 9	16 6	19 6	21 0
19	9 6	9 10 ¹ / ₂	10 3 ¹ / ₂	10 8 ¹ / ₂	11 1	11 3 ¹ / ₂	11 6 ¹ / ₂	11 8 ¹ / ₂	11 10 ¹ / ₂	12 0 ¹ / ₂	12 3 ¹ / ₂	12 5 ¹ / ₂	12 8	13 0 ¹ / ₂	13 5 ¹ / ₂	14 3	15 0 ¹ / ₂	15 10	16 7 ¹ / ₂	17 5	20 7	22 2
20	10 0	10 5	10 10	11 3	11 8	11 10 ¹ / ₂	12 1	12 3 ¹ / ₂	12 6	12 8 ¹ / ₂	12 11	13 1 ¹ / ₂	13 4	13 9	14 2	15 0	15 10	16 8	17 6	18 4	21 8	23 4
21	10 6	10 11 ¹ / ₂	11 4 ¹ / ₂	11 9 ¹ / ₂	12 3	12 5 ¹ / ₂	12 8 ¹ / ₂	12 10 ¹ / ₂	13 1 ¹ / ₂	13 4 ¹ / ₂	13 6 ¹ / ₂	13 9 ¹ / ₂	14 0	14 5 ¹ / ₂	14 10 ¹ / ₂	15 9	16 7 ¹ / ₂	17 6	18 4 ¹ / ₂	19 3	22 9	24 6
22	11 0	11 6 ¹ / ₂	11 11	12 4 ¹ / ₂	12 10	13 0 ¹ / ₂	13 3 ¹ / ₂	13 6 ¹ / ₂	13 9	13 11 ¹ / ₂	14 2 ¹ / ₂	14 5 ¹ / ₂	14 8	15 1 ¹ / ₂	15 7	16 6	17 5	18 4	19 3	20 2	23 10	25 8
23	11 6	11 13 ¹ / ₂	12 5 ¹ / ₂	12 11 ¹ / ₂	13 5	13 7 ¹ / ₂	13 10 ¹ / ₂	14 1 ¹ / ₂	14 4 ¹ / ₂	14 7 ¹ / ₂	14 10 ¹ / ₂	15 1 ¹ / ₂	15 4	15 9 ¹ / ₂	16 3 ¹ / ₂	17 3	18 2 ¹ / ₂	19 2	20 1 ¹ / ₂	21 1	24 11	26 10
24	12 0	12 6	13 0	13 6	14 0	14 3	14 6	14 9	15 0	15 3	15 6	15 9	16 0	16 6	17 0	18 0	19 0	20 0	21 0	22 0	26 0	28 0
25	12 6	13 0 ¹ / ₂	13 6 ¹ / ₂	14 0 ¹ / ₂	14 7	14 10 ¹ / ₂	15 1 ¹ / ₂	15 4 ¹ / ₂	15 7 ¹ / ₂	15 10 ¹ / ₂	16 1 ¹ / ₂	16 4 ¹ / ₂	16 8	17 2 ¹ / ₂	17 8 ¹ / ₂	18 9	19 2 ¹ / ₂	20 10	21 10 ¹ / ₂	22 11	27 1	29 2
26	13 0	13 6 ¹ / ₂	14 1	14 7 ¹ / ₂	15 2	15 5 ¹ / ₂	15 8 ¹ / ₂	15 11 ¹ / ₂	16 3	16 6 ¹ / ₂	16 9 ¹ / ₂	17 0 ¹ / ₂	17 4	17 10 ¹ / ₂	18 5	19 6	20 7	21 8	22 9	23 10	28 2	30 4
27	13 6	14 0 ¹ / ₂	14 7 ¹ / ₂	15 2 ¹ / ₂	15 9	16 0 ¹ / ₂	16 3 ¹ / ₂	16 6 ¹ / ₂	16 10 ¹ / ₂	17 1 ¹ / ₂	17 5 ¹ / ₂	17 8 ¹ / ₂	18 0	18 6 ¹ / ₂	19 1 ¹ / ₂	20 3	21 4 ¹ / ₂	22 6	23 7 ¹ / ₂	24 9	29 3	31 6
28	14 0	14 7	15 2	15 9	16 4	16 7 ¹ / ₂	16 11	17 2 ¹ / ₂	17 6	17 9 ¹ / ₂	18 1	18 4 ¹ / ₂	18 8	19 3	19 10	21 0	22 2	23 4	24 6	25 8	30 4	32 8
29	14 6	15 1 ¹ / ₂	15 8 ¹ / ₂	16 3 ¹ / ₂	16 11	17 2 ¹ / ₂	17 6 ¹ / ₂	17 9 ¹ / ₂	18 1 ¹ / ₂	18 5 ¹ / ₂	18 8 ¹ / ₂	19 0 ¹ / ₂	19 4	19 11 ¹ / ₂	20 6 ¹ / ₂	21 9	22 11 ¹ / ₂	24 2	25 4 ¹ / ₂	26 7	31 5	33 10
30	15 0	15 7 ¹ / ₂	15 3	16 10 ¹ / ₂	17 6	17 9 ¹ / ₂	18 1 ¹ / ₂	18 5 ¹ / ₂	18 9	19 0 ¹ / ₂	19 4 ¹ / ₂	19 8 ¹ / ₂	20 0	20 7 ¹ / ₂	21 3	22 6	23 9	25 0	26 3	27 6	32 6	35 0

RULE FOR CALCULATING PROPORTIONED WIDTH AND HEIGHT OF TREADS AND RISES OF STAIRS.

Subtract the width of tread from 25 in. and the result will be twice the height of the riser. Thus: if the tread is 10 in. wide, then $25 - 10 = 15 \div 2 = 7\frac{1}{2}$ in., the height or riser proportionate to a 10-inch tread. This is exclusive of nosings.



SPACE OCCUPIED BY AUTOMOBILES.

Touring Cars.

Length, 13 ft. 6 in. to 20 ft.

Height, 7 ft. 3 in.

Width, 6 ft. 0 in.

Smallest practical door, 8 ft. 0 in. high by 8 ft. 0 in. wide. Alley door should be not less than 11 ft. 4 in. and should be set not less than 22 ft. from opposite side.

Heavy Trucks.

Length, 15 ft. to 26 ft.

Width, 6 ft. 0 in.

Height, 10 ft. 0 in.

Width on floor between wheel pockets, 48 in. Length of wheel pocket, 34 in.

Smallest practical door, 9 ft. 0 in. wide by 11 ft. 0 in. high; for largest trucks, 13 ft. 6 in. high.

Doors to alley should not be less than 12 ft. wide and should be set not less than 28 ft. from opposite side of alley.

Moving Vans.

Length, 13 ft. to 26 ft. 6 in.

Width, 7 ft. to 8 ft. 2 in.

Height, 10 ft. to 12 ft.

Smallest practical door 10 ft. 0 in. wide by 13 ft. 6 in. high.

CLEARANCE UNDER OLD ELEVATED RAILWAY STRUCTURES AND TROLLEY WIRES, 12 FT. 0 IN.

Clearance required by the city for steam roads, 13 ft. 6 in.

Architects will be perfectly safe in making the maximum limit of door heights for any sort of vehicle 13 ft. 6 in., standard subway height, as no vehicle can be used commercially on the streets of Chicago that will not clear steam road viaducts. They might go around elevated viaducts, but they can not go around steam road viaducts and there is a probability that any future elevated viaducts would be raised to the city standard height of 13 ft. 6 in.

FURNITURE DIMENSIONS.

FILE 720 042

Chairs—Height of seat, 18"; depth of seat, 19"; top of back, 38"; arms, 9" above seat.

Lounges—6' long, 30" wide.

Tables—Writing, height, 2'-5"; sideboards, height, 3'-0"; general height, 2'-6".

Note—The smallest size practical for knee holes, 2' high by 1'-8" wide.

Beds—Single, width, 3' to 4'; $\frac{3}{4}$ bed, width, 4'; double bed, width, 4'-6" to 5'-0", length 6'-6" to 6'-8"; standard double bed, 4'-6" x 6'-6"; footboards, 2'-6" to 3'-6" high; headboards, 5' to 6'-6".

Bureaus—Common, width, 3'-5" or 4'; depth, 1'-6" or 1'-8"; height, 2'-6" or 3'.

Commodore—Top, 1'-6" square and 2'-6" high.

Chiffoniers—3' wide, 1'-8" deep, 4'-4" high.

Cheval Glasses—Height, 6'-4" or 5'-0" or 5'-2"; width, 3'-2" or 2'-6" or 1'-8".

Washstands—Length, 3'-0"; width, 1'-6"; height, 2'-7".

Wardrobes—Length, 4'-6"—3'-0"; depth, 2'-0"—1'-5"; height, 8'-0".

Sideboards—Length, 5' to 6'; depth, 2'-2".

Pianos—Upright, length, 4'-10" to 5'-6"; height, 4'-4" to 4'-9"; depth, 2'-4". Square, length, 6'-8"; depth, 3'-4".

Billiard Tables—4'-8", $4\frac{1}{2}$ " x 9, 5' x 10. Must have 16" x 20" space.

Wardrobe Shelves—5'-10" high.

Coat Hooks—5'-6" high.

Flour Barrel—28" to 30" high and 20" to 21" dia.

DATA ON BUILDINGS WITH SIDINGS.

Clearance from face of building to center of track, 7'-0".

Height of loading decks:

For shipping, 4'-0".

For receiving, 3'-0".

Clearance from center of track to edges of loading decks:

Upper edge, 7'-0".

Lower edge, 5'-0".

Spec. No.	No. of Stops.	From Back to Front Line of Case.	Width of Space Required.	Height Required for Swell-Box and Large Pipes.
5	10	7' 4"	11' 6"	12' 6"
7	11	8'	11' 6"	12' 6"
8	12	8'	12' 6"	12' 6"
10	13	8' 7"	12' 6"	12' 6"
11	14	9' 3"	12' 6"	12' 6"
13	16	10' 5"	12' 6"	12' 6"
14	17	11'	14' 8"	17'
16	18	11' 7"	14' 8"	17'
17	19	12' 2"	14' 8"	17'
19	20	12' 9"	14' 8"	17'

Spec. No.	No. of Stops.	From Back to Front Line of Case.	Width of Space Required.	Height Required for Swell-Box and Large Pipes.
20	21	12' 9"	15' 6"	17'
22	22	13' 4"	15' 6"	17'
23	23	13' 6"	15' 6"	17'
25	24	14'	15' 6"	17'
26	25	14' 6"	15' 6"	17'
28	26	14' 6"	15' 6"	17'
29	27	14' 6"	16' 4"	17' 6"
31	28	15'	16' 4"	17' 6"
32	29	15' 6"	16' 4"	17' 6"
34	30	15' 6"	17'	17' 6"

Add 40" more from Front Line of Case for Keydesk Pedals and Seat.

PROBLEMS ON THE ELLIPSE & PARABOLA

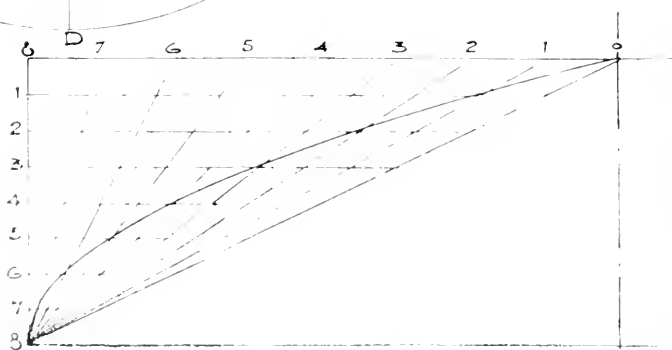
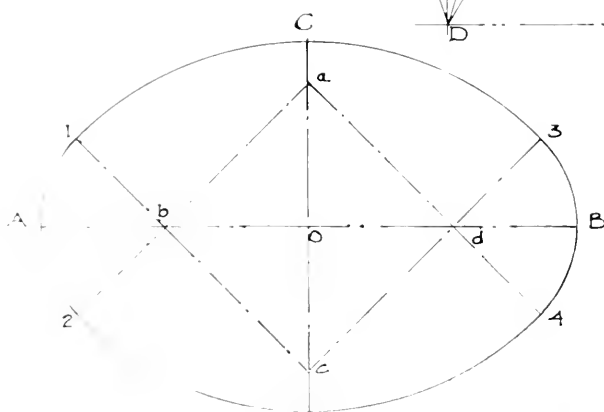
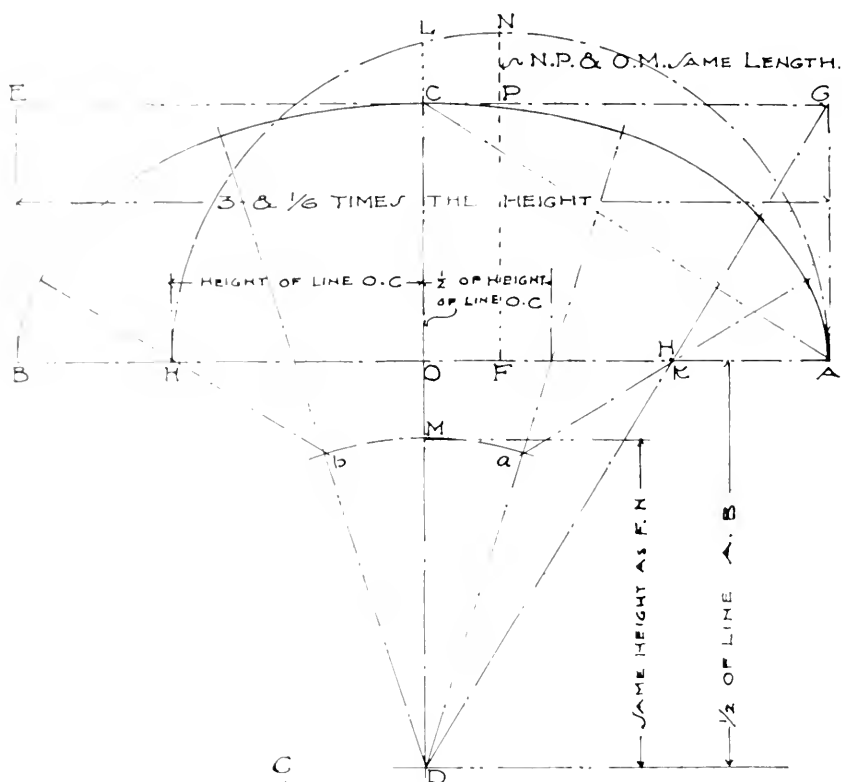
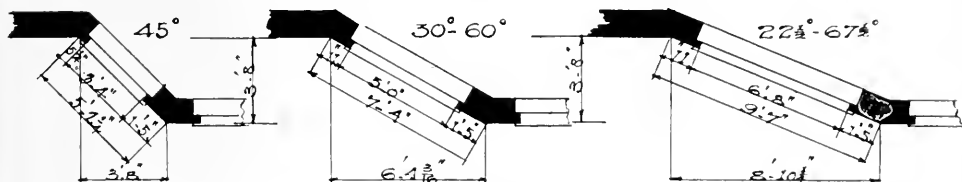


Table Showing the Length of Sides of Bays, Angle being
45, 30-60 and 22½-67½ Degrees.



Examples.

Angle of 45 Degrees.

1 ft.	6 in.	by	1 ft.	6 in.	2 ft.	1 7/8 in.	2 ft.	10 in.	by	2 ft.	10 in.	4 ft.	0 1/8 in.
1	7	"	1	7	"	2 1/8	2	11	"	2	11	"	1 1/8
1	8	"	1	8	"	2 3/8	3	0	"	3	0	"	2 1/8
1	9	"	1	9	"	2 5/8	3	1	"	3	1	"	2 3/8
1	10	"	1	10	"	2 7/8	3	2	"	3	2	"	2 5/8
1	11	"	1	11	"	3 1/8	3	3	"	3	3	"	2 7/8
2	0	"	2	0	"	3 3/8	3	4	"	3	4	"	2 9/8
2	1	"	2	1	"	3 5/8	3	5	"	3	5	"	3 1/8
2	2	"	2	2	"	3 7/8	3	6	"	3	6	"	3 3/8
2	3	"	2	3	"	4 1/8	3	7	"	3	7	"	3 5/8
2	4	"	2	4	"	4 3/8	3	8	"	3	8	"	3 7/8
2	5	"	2	5	"	4 5/8	3	9	"	3	9	"	3 9/8
2	6	"	2	6	"	4 7/8	3	10	"	3	10	"	3 11/8
2	7	"	2	7	"	5 1/8	3	11	"	3	11	"	3 13/8
2	8	"	2	8	"	5 3/8	4	0	"	4	0	"	3 15/8
2	9	"	2	9	"	5 5/8							

Angle of 30-60 Degrees.

1 ft.	6 in.	by	2 ft.	7 1/8 in.	3 ft.	0 in.	2 ft.	10 in.	by	4 ft.	10 7/8 in.	5 ft.	8 in.
1	7	"	2	8 1/8	3	2	2	11	"	5	10 5/8	5	10
1	8	"	2	10 3/8	3	4	3	0	"	5	12 3/8	6	0
1	9	"	2	10 5/8	3	6	3	1	"	5	14 3/8	6	2
1	10	"	2	12 1/8	3	8	3	2	"	5	16 3/8	6	4
1	11	"	2	12 3/8	3	10	3	3	"	5	18 3/8	6	6
2	0	"	3	15 1/8	4	0	3	4	"	5	20 3/8	6	8
2	1	"	3	17 1/8	4	2	3	5	"	5	22 3/8	6	10
2	2	"	3	19 1/8	4	4	3	6	"	6	24 3/8	7	0
2	3	"	3	21 1/8	4	6	3	7	"	6	26 3/8	7	2
2	4	"	4	23 1/8	5	8	3	8	"	6	28 3/8	7	4
2	5	"	4	25 1/8	5	10	3	9	"	6	30 3/8	7	6
2	6	"	4	27 1/8	5	12	3	10	"	6	32 3/8	7	8
2	7	"	4	29 1/8	5	14	2	11	"	6	34 3/8	7	10
2	8	"	4	31 1/8	5	16	4	0	"	6	36 3/8	8	0
2	9	"	4	33 1/8	5	18							

Angle of 22½-67½ Degrees.

1 ft.	6 in.	by	3 ft.	7 7/8 in.	3 ft.	11 in.	2 ft.	10 in.	by	9 ft.	10 1/2 in.	7 ft.	4 1/8 in.
1	7	"	3	9 7/8	4	1 5/8	2	11	"	9	12 1/2	7	7 1/8
1	8	"	3	10 7/8	4	2 5/8	3	0	"	9	14 1/2	7	10 1/8
1	9	"	3	11 7/8	4	3 5/8	3	1	"	9	16 1/2	8	0 1/8
1	10	"	3	12 7/8	4	4 5/8	3	2	"	9	18 1/2	8	3 1/8
1	11	"	3	13 7/8	5	5 5/8	3	3	"	9	20 1/2	8	5 1/8
2	0	"	4	15 7/8	5	6 5/8	3	4	"	8	22 1/2	8	8 1/8
2	1	"	4	17 7/8	5	7 5/8	3	5	"	8	24 1/2	8	11 1/8
2	2	"	4	19 7/8	5	8 5/8	3	6	"	8	26 1/2	9	1 1/8
2	3	"	5	21 7/8	5	9 5/8	3	7	"	8	28 1/2	9	4 1/8
2	4	"	5	23 7/8	6	10 5/8	3	8	"	8	30 1/2	9	7 1/8
2	5	"	5	25 7/8	6	11 5/8	3	9	"	9	32 1/2	9	9 1/8
2	6	"	6	27 7/8	6	12 5/8	3	10	"	9	34 1/2	10	0 3/8
2	7	"	6	29 7/8	6	13 5/8	3	11	"	9	36 1/2	10	2 3/8
2	8	"	6	31 7/8	6	14 5/8	4	0	"	9	38 1/2	10	5 1/8
2	9	"	6	33 7/8	7	15 5/8							

Sizes of Piano.

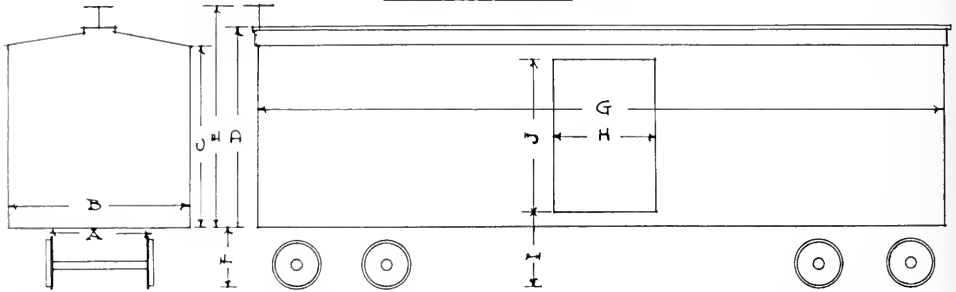
7½ Octaves.

	Height.	Length.	Width.
Upright	about 4 ft. 8 in.	5 ft. 4 in.	2 ft. 3 in.
Small or Baby Grand.....	about 3 ft. 2 in.	5 ft. 2 in.	4 ft. 10 in.
Parlor Grand	about 3 ft. 2 in.	6 ft. 11 in.	5 ft. 0 in.
Size of Large Victrolas 49¾ in. high; 24 in. wide; 25½ in. deep.			

SIZES OF FREIGHT CARS.

In response to the numerous requests of architects that we give information as to car and track sizes, etc., essential to the proper planning of buildings where car service is required, we have taken measures of a number of different cars and present below

a diagram indicating dimensions of same which we hope to be sufficiently general to meet the architect's needs. It will be noted that there is a wide variation in the size of cars designed for various purposes and built by the different roads.



Car.	A	B	C	D	E	F	G	H	I	J
North-Western	59"	9'-0"	9'-4"	10'-4"	10'-10"	38"	34'-0"	60"	49"	7'-6"
Chicago & Alton.....	"	9'-3"	9'-0"	10'-6"	11'-0"	36"	40'-6"	72"	48"	7'-8"
New York Central.....	"	9'-3"	9'-2"	10'-2"	10'-10"	42"	36'-6"	72"	48"	8'-0"
Baltimore & Ohio.....	"	9'-4"	8'-10"	9'-10"	10'-6"	37"	36'-6"	72"	42"	7'-7"
Pacific Fruit Express.....	"	9'-3"	9'-0"	9'-10"	10'-3"	40"	33'-9"	48"	50"	6'-2"
North-Western Furniture..	"	9'-6"	10'-6"	11'-6"	12'-0"	30"	50'-6"	144"	40"	9'-8"
Cotton Belt.....	"	9'-3"	9'-6"	10'-6"	11'-6"	38"	36'-6"	62"	48"	7'-8"
Chicago & Alton.....	"	9'-2"	8'-8"	9'-8"	10'-11"	37"	34'-8"	66"	47"	6'-8"
North-Western	"	9'-4"	9'-2"	10'-2"	11'-2"	39"	36'-6"	60"	49"	7'-6"
North-Western	"	9'-2"	8'-5"	9'-6"	10'-7"	36"	34'-6"	60"	46"	6'-10"
Erie	"	9'-6"	8'-8"	9'-8"	10'-10"	40"	34'-10"	62"	50"	6'-10"

Quoting from Bulletin No. 119, the American Engineering and Maintenance of Ways Association, issued in January, 1910, we find they recommend that the cross section of single track tunnels shall be 12' in width, 16' in height from the top of ties to the spring of arch and the arch to have a radius of 8', making the distance from top of ties to top of arch 20' and the ballast extend for a distance of 2' below the top of ties which they designate as sub-grade. Apparently this would indicate that it is undesirable to locate the walls or columns of a building closer than 8' from the center of a track, in order to prevent the crushing of a person

caught between the track and the walls. The committee reports under "Rules for Roundhouse Construction" that turntables should not be less than 75' feet in length; that length of stalls for engines should not be less than 85' clear, in length; that the clear opening of entrance doors should not be less than 13' in width and 16' in height, which would indicate that straight tracks can be placed 13' from centers. Allowance, however, should be made for clearance of projection of car beyond trucks at curves. The old rules permitted entrance doors to be reduced to 12' in width. Increased size in cars account for new recommendation.

Size of Swimming Tank.

FILE 726.74

Swimming tanks that can be used for swimming contests must be exactly 20 yards in interior length, no less. (A tank ½ inch short would be ruled out of contest.) Eight yards wide is best, although 7 yards will pass; 4 feet deep at shallowest point and 8 feet deep at deepest point, which deepest point should be about 12 feet from end where springboard is placed. Depth at springboard

end should be six feet. Interior of tank, both sides and bottom, should be white, and there should be three black lines on the bottom extending parallel with sides, and dividing the tank into four equal alleys; there should be a line across tank on bottom and up sides at exactly 2 yards from each end, measured horizontally, making lines exactly 16 yards apart horizontally.

Size of the Billiard Room, Gas Light, Etc.

The space required for the different sized tables is as follows:

For table 6 x 12, Room should be 16 x 22
 For table 5½ x 11, Room should be 15½ x 21
 For table 5 x 10, Room should be 15 x 20
 For table 4½ x 9, Room should be 14 x 18½
 For table 4 x 8, Room should be 13 x 17
 For table 3½ x 7, Room should be 12½ x 16

The following directions for arranging the lights over billiard tables will be found use-

ful. The distance of the light from the floor should be about 6 feet 2 inches. For a 5½ by 11 table, cross-arms 31 inches and long arms 62 inches. For a 5 by 10 table, the cross-arms of the pendant should measure, from light to light, 28 inches and the long arm 56 inches. For a 4½ by 9 table, cross-arms 25 inches and long arms 50 inches. For a 4 by 8 table, cross-arms 22 inches and long arms 44 inches.

MASONRY, PLASTERING AND FIREPROOFING.

Weight of Brickwork

Placing the weight of brickwork at 112 lb. per cubic foot, the weights per superficial foot for different walls are:

9 inch wall.....	84 lb.
13 inch wall.....	121 lb.
18 inch wall.....	168 lb.
22 inch wall.....	205 lb.
26 inch wall.....	243 lb.

Measurement of Old Brick

Uncleaned rough from building dumped from 8 to 10 bricks per cubic foot, or average of 111 cubic feet to the M.

Uncleaned stacked on outside and interior of stack filled promiscuously 10-12 per cubic foot, or average of 91 cubic feet to the M.

Cleaned and closely stacked, 16 to 18 bricks per cubic foot, or actual average of 59 cubic feet to M. (Usually sold at 60 cubic feet to M. to allow for waste and poor piling.)

Cleaned stacked on outside and interior filled promiscuously, 12 to 14 per cubic foot, or actual average of 77 cubic feet to M. (When sold from pile measure customary to count 80 cubic feet to M. to allow for waste and bats.)

Measurement of New Brickwork.

The Chicago Masons and Builders' Association have arbitrarily assumed that a cubic foot of wall contains $22\frac{1}{2}$ common brick, or $7\frac{1}{2}$ brick to the superficial foot of 4-inch wall and 15 brick to the superficial foot of 8-inch wall. These figures of the Masons' and Builders' Association are frequently used for the appraisal of party walls, etc., but if so used, the price per M for work in wall should be reduced accordingly.

The actual number of Chicago common brick required for a cubic foot of solid wall varies from $17\frac{1}{2}$ to $19\frac{1}{2}$, and masons in purchasing brick usually reserve 18 brick per cubic foot of solid wall; and when so doing, rarely find an excess or shortage at the end of construction. When the walls are divided into many small piers, requiring much cutting, and consequently much waste, it is best to figure 20 brick to the cubic foot.

On account of the wide variance of practice on the part of masons in estimating, architects, when calling for estimates on brick work by the thousand, will avoid useless controversy by stipulating that quantity of brick will be determined by superficial wall measurement according to the following rule, which is very nearly correct, as Chicago brick now run. Divide the total number of superficial feet of wall surface of a given thickness by 160, and multiply the result by the number of brick widths the wall is thick, and the result will equal the number of thousands of brick contained. A four-inch wall will contain $6\frac{1}{4}$ brick to the superficial foot, or 1,000 brick to 160 square feet.

Miscellaneous Masonry Data.

One hundred yards of plastering will require fourteen hundred laths, four and a half bushels of lime, four-fifths of a load of sand, nine pounds of hair and five pounds of nails, for two-coat work.

A load of mortar measures a cubic yard, requires a cubic yard of sand and nine bushels of lime, and will fill thirty hods.

A bricklayer's hod measuring one foot four inches by nine inches, equals 1.296 cubic inches in capacity, and contains twenty bricks.

A single load of sand or other materials equals a cubic yard.

Cement Mortars.

FILE 693.2

S. W. Curtiss, an authority on mortars states that the only way lime mortar will set is by chemical combination with carbonic acid gas. In common practice this always comes from the atmosphere. Anything excluding air from lime mortar will prevent its setting; for this reason it is detrimental to lay imporous brick in lime mortar as such brick do not conduct air through same to the mortar joint and the only air that can come in contact with the mortar must pass through the mortar itself.

Cement mortar sets by crystallization, which means that in order to set cement must be supplied with water. In consequence cement mortar sometimes fails to set, or harden when used for laying porous brick because of the fact that capillarity draws all of the moisture out of the mortar into the brick and it does not have sufficient water for crystallization. Porous brick if laid in cement mortar should be thoroughly soaked so as to fill the pores and destroy the tendency to absorb moisture from the mortar. Nearly all stone products if ground fine enough will crystallize when mixed with water forming a cement of greater or less strength according to the character of the material and the fineness of the grinding. Calcareous matters or Portland cement which will not pass a 100 mesh sieve are incapable of crystallization and therefore valueless as a cementing material. The introduction of sand or stone products in cement not ground so as to pass 100 mesh reduces the amount of cementing material to the volume and at the same time increases its efficiency. A one hundred volume of neat cement that has a tensile strength of 700 pounds to the square inch will, when used with a four hundred volume of properly assorted gravel give a tensile strength of three hundred fifty pounds to the square inch. As there are five square inches the cement holds five times 350 or 1,750. Thus increasing the efficiency of the cement two and one-half times, and at the same time the proper proportion of graded gravels eliminate shrinking or swelling of the mass. While neat cement is stronger per cubic inch than the concrete, it is necessary in practical use to combine it with proper quantity of proper aggregates to avoid craze cracking from shrinkage. The smaller proportion of water in Portland cement making it workable gives the greatest strength. Neat Portland will take 22% of water to make it workable. This is an excess of water needed in the crystallization. In compressing it is impossible to compress the water, causing a shrinkage when crystallization takes place. When Portland cement is used with four volumes of aggregates 8% of the five volumes of water will make a workable material. This can be compressed without the danger of shrinkage. The cement attacks the silica of the aggregates, crystallizing into one mass. The introduction of quick lime into cement mortar means weakening the strength of the mortar way out of proportion to the amount of lime introduced. The effect is much worse than the introduction of an increased amount of sand except that the lime has a slightly retardative effect on the setting of the cement.

Hydrated lime in small quantities is probably less injurious than slacked lime. Cement has a tendency to prevent the setting of lime, by excluding the atmosphere, while lime has a tendency to prevent the setting of cement by absorbing moisture required for crystallization of the cement.

FRAMED AND BOXED CONSTRUCTION CARPENTRY, STRUCTURAL AND ORNAMENTAL IRON.

ESTIMATE DATA FOR ORDINARY STUD AND JOIST CONSTRUCTION.

By EMERY STANFORD HALL, B. S.

No hard and fast rule can be laid down for estimating. There are so many practical exigencies which alter assumed or average conditions that experience and judicial capacity are essential to successful estimating. Manifestly a well organized force commanded by men of executive ability can accomplish more and better work in less time and with less waste than a poor organization of inefficient men under incapable direction. Likewise work easily accessible and simple in design can be executed by any force with less waste and in less time than complicated work or work executed at a high altitude, requiring much scaffolding and hoisting apparatus.

FLOOR FRAMING.

The number of joists required is always in excess of the number which would naturally be called for by uniform spacing as indicated in Fig. 1 "Floor Construction, type C." Extra joists have to be put in to form trimmers and headers around chimneys, stair-wells, and other openings in floors. Also, joists should be doubled under partitions with block separators between so as to permit pipes passing through without cutting. These conditions, as illustrated below in Fig. 1, "Type E Floor Construction," show a case where 14 joists are required in only ten uniform spacings, which is extreme, but taking an average of type "E" and type "C," conditions which occur with about equal frequency in buildings of average requirements, it is reasonable to assume that two extra joists will be required for every ten feet.

Number of thousands of board feet in joists for any uniform bent of any building, with any length of joists, when width of bent plus the joist bearing on walls or girders = 1; any stretch or depth of the bent parallel to joist bearings = L; any uniform distance between centers of joists = s; and J =

$$\text{the result:—} J = \frac{b d l}{1000} \left(\frac{2L}{10} - \frac{1}{s} \right) \quad \text{b d l} \quad \text{the}$$

number of board feet of material in a piece of timber (b) thick by (d) in depth and (l) in length, and the values of same for material most generally used are given in table A.

Let $\frac{b d l}{12}$ B

$$(1.) J = \frac{B}{1000} \left(\frac{2L}{10} - \frac{1}{s} \right) \quad s \text{ is commonly equal}$$

either to 1 ft. or $1\frac{1}{2}$ ft. Substituting 1 for value of s = joists placed 12" from C.

(2.) J = .0012 L B. Substituting $1\frac{1}{2}$ for value of s = joists placed 16" from C.

$$(3.) J = .00095 L B.$$

$$(4.) J = .0008 L B.$$

To find the average amount of material contained in a square of 100 sq. ft. floor construction take a value of B corresponding to 1 = 10, and a value of L = 10 and substitute in either formula (1.), (2.) or (3.) according to spacing desired. The following "Table I" gives the result of such substitution for some of the more commonly used sizes of joists:

TABLE I.

1 = 10 L = 10		Number of M's of bd. ft. in a square of 100 sq. ft. for various joists in construction			
b d	$\frac{10 b d}{12}$	B	J s = 1	J s = $1\frac{1}{2}$	J s = $1\frac{3}{4}$
2 x 2	3.34	.04008	.031730	.06720	
2 x 4	6.67	.08004	.063365	.05336	
2 x 6	10.00	.12000	.095000	.08000	

1 = 10
L = 10

Number of M's of bd. ft. in a
square of 100 sq. ft. for various
joists in construction.

b d	$\frac{10 b d}{12}$	B	J s = 1	J s = $1\frac{1}{2}$	J s = $1\frac{3}{4}$
2 x 8	13.34	.16008	.126730	.10672	
2 x 10	16.67	.20004	.158365	.13336	
2 x 12	20.00	.24000	.190000	.16000	
2 x 14	23.34	.28008	.221730	.18672	
2 x 16	26.67	.32004	.253365	.21336	
3 x 6	15.00	.18000	.142500	.12000	
3 x 8	20.00	.24000	.190000	.16000	
3 x 10	25.00	.30000	.237500	.20000	
3 x 12	30.00	.36000	.285000	.24000	
3 x 14	35.00	.42000	.332500	.28000	
3 x 16	40.00	.48000	.380000	.32000	
4 x 4	13.34	.16008	.126730	.10672	
4 x 6	20.00	.24000	.190000	.16000	
4 x 8	26.67	.32004	.233365	.21336	
4 x 10	33.34	.40008	.316730	.26672	
4 x 12	40.00	.48000	.380000	.32000	
4 x 14	46.67	.56004	.443365	.37336	
4 x 16	53.34	.64008	.506730	.42672	
COL. I	COL. II	COL. III	COL. IV	COL.	

Col. I gives size of joists or sticks of timber. Col. II gives the number of board feet in a stick of the size given in Col. I and 10 ft. long. Col. III gives the amount of M of bd. ft. of framing material contained in a square of 100 sq. ft. for joists of the size given in Col. I when these joists are placed 12" from centers; Col. IV when placed 16" from centers; Col. V when placed 20" from centers.

Bridging where placed 8 ft. on centers requires 12 pairs to the square where joists are placed 12" from centers; 9½ pair where joists are placed 16" from centers.

PARTITION CONSTRUCTION.

The amount of material and labor involved in the various types of ordinary stud partitions is practically uniform for a given height of partition, spacing of studs and size of same. See types "F" and "G" in illustration below. Type "F" has two layer bottom plate or shoe, 1 line of block-bridging and a single layer top-plate, while type "G" has two layer bottom-plate or shoe and two layer cap-plate with no block-bridging, giving the same actual amount of material. Stud partitions are usually spaced out and studs set on uniform spacing, regardless of openings; then the openings are cut and the studs around same doubled, requiring extra studs, as the posts at sides of openings rarely happen to fall on the line with studs originally placed. Door opening Fig. 1, type "A" is usual condition. Door opening Fig. 1, type "B," where both posts fall in line with studs as first set, is a type which almost never occurs in actual practice and so cannot be considered as a possible saving on material. "Section AA," Fig. 1, shows connecting partitions from various directions and makes clear the necessity for extra studs above the number required for regular spacing to provide for angles. It will be seen that every angle requires from 2 to 4 extra studs. The pieces of studs cut out for openings are used for doubling, but there are not sufficient to supply all extra stud-ding needed.

Number of thousands of board feet in studs for any partition with any length of studs, when length of studs between shoe and cap-plate = l; any length of partition measured in the horizontal direction and through all angles, so as to increase the actual length of partition by the thickness of same at angles = L; any uniform distance between centers of studs = s; and Q = the result:

Observing Fig. 1, it will be seen that average value of $Q = \left[\frac{\left(\frac{L}{s} + \frac{8L}{10} \right) h + 4L}{1000} \right] \frac{\text{ft. ft.}}{12 \cdot 14} =$ the number of board feet of material in a piece of timber or stud; (f) face by (t) thickness and one ft. in length and the values of same for sizes of material most generally used are given in Table II, Col. II. Let $\frac{\text{ft.}}{12} = F$.

(5.) $Q = F \left[\left(\frac{L}{s} + \frac{8L}{10} \right) h + 4L \right] \cdot s$ is commonly equal either to 1 or $1\frac{1}{2}$, sometimes $1\frac{3}{4}$. Substituting 1' for value of s = studs placed 12" from C.

$$(6.) Q = \left(\frac{1.8Lh + 4L}{1000} \right) F.$$

TABLE II

Size of studs f x t	L=10 $\frac{\text{ft.}}{12} = F$	12 spacing $Q = \frac{1}{h=10}$	16 spacing $Q = \frac{1\frac{1}{2}}{h=10}$	20 spacing $Q = \frac{1\frac{3}{4}}{h=10}$
1"x 1"	.084	.01848	.016380	.01512
1 x 2	.167	.03674	.03240	.03060
2 x 2	.334	.07348	.06480	.0612
2 x 3	.500	.11000	.09750	.09000
2 x 4	.667	.14674	.11027	.12006
2 x 6	1.000	.22000	.19500	.18000
2 x 8	1.334	.29348	.26013	.24012
3 x 4	1.000	.22000	.19500	.18000
3 x 6	1.500	.33000	.29250	.27000
3 x 8	2.000	.44000	.38000	.36000
4 x 4	1.334	.30448	.26013	.24012
4 x 6	2.000	.44000	.39000	.36000
4 x 8	2.667	.58675	.52007	.48006
COL. I	COL. II	COL. III	COL. IV	COL. V

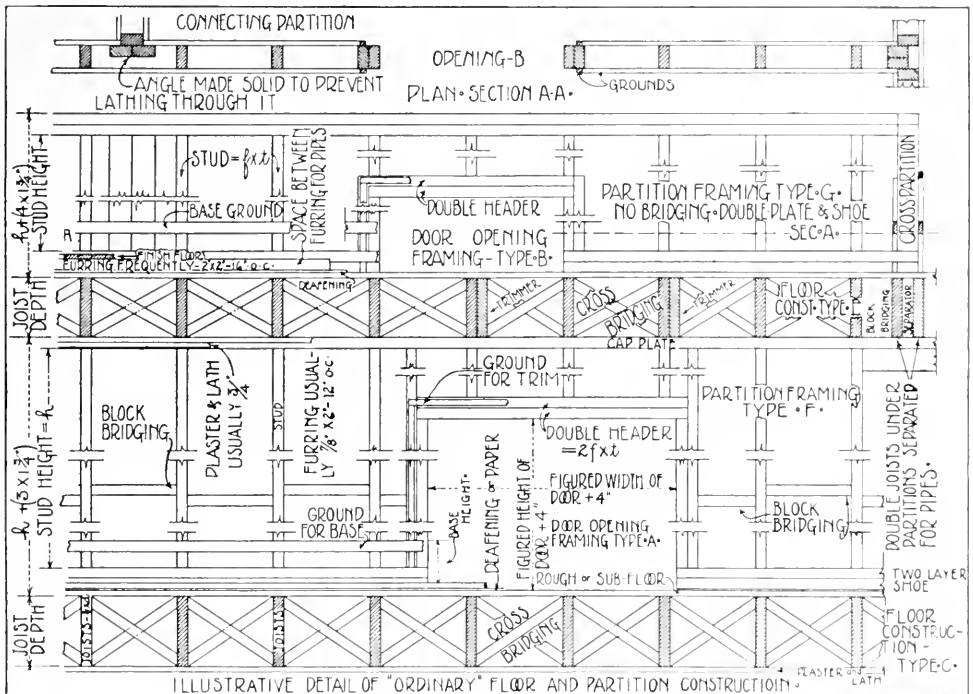


Fig. 1.

Substituting $1\frac{1}{2}$ ' for value of s = studs spaced 16" from c.

$$(7.) \left(\frac{1.55Lh + 4L}{1000} \right) F.$$

Substituting $1\frac{3}{4}$ ' for value of s = studs spaced 20" from c.

$$(8.) \left(\frac{1.4Lh + 4L}{1000} \right) F.$$

To find the average number of M's of bd. ft. of framing material contained in a square of 100 sq. ft. of partition construction take a value of F corresponding to size of studs used (see Col. II, Table II below) and a value of $L=10$ and substitute in either formula (5.), (6.), (7.) or (8.), according to spacing desired. This really will give a partition three or four \times greater in one dimension than 10 ft., but this should be allowed extra for places where the material will not cut to advantage. The following Table II gives the result of such substitution for some of the more commonly used sizes of joists. (6.) becomes $Q=.22 F$; (7.) becomes $Q=.195 F$; (8.) becomes $Q=.18 F$.

Col. I gives sizes of studs or furring strips. Col. II gives the number of board feet in a stick of the size given in Col. I and one ft. long. Col. III gives the number of M's of bd. ft. of framing material contained in a square of 100 sq. ft. of stud partition or furring, including extras and waste if constructed of studs of the size indicated in Col. I and spaced 12" from centers; Col. IV, spaced 16" from centers; Col. V, spaced 20" from centers.

Grounds are usually placed for nailing base-boards, dado-caps, and trim around openings. These are sometimes made 1" x 1" and sometimes 1" x 2" and are put up on both sides of partitions.

Number of thousands of board feet in grounds for a partition of any length and height = $G = \left(\frac{4L + 5h}{1000} \right) F$ when O = the number of openings and can be assumed to average $\frac{1}{10}$.

$$(9.) \quad G = \left(\frac{4L + 5Lh}{1000} \right) F.$$

For one square $L=10$, $h=10$, then $G=0.9 F$. Value of F can be substituted from Table II, Col. II.

For $1'' \times 1''$ grounds $G=.00756 M$; for $1'' \times 2''$ $G=.01503 M$ bd. ft.

EXTERIOR WALL CONSTRUCTION.

Frame exterior wall construction is so similar to interior stud partition construction that for purposes of estimating quantity of material to determine cost Table II may be used for estimating this work.

Furring is applied to exterior masonry walls, usually $1'' \times 2''$ spaced either $12''$ or $16''$ from centers; similar furring is sometimes applied to the under side of joists to receive lath and also on top of rough floors to afford space for pipes; but here it is frequently $2'' \times 2''$. Not as much extra furring is actually put into the building as extra studs estimated in Table II, but there is so much waste of this material that amounts given in Table II should be used in estimating.

Coverings of Partitions, Walls, Floors and Ceilings are measured by the surface area of each layer. Most such material is either lapped, matched or otherwise cut to waste, so that the surface area purchased will not cover the same amount of frame surface. This varies with different materials and the following table gives values of the factor W , by which the actual measurement of surfaces must be multiplied to determine the amount of material which must be purchased.

TABLE III.

$W=1$ for plain boards laid close.
 $W=.65$ for $1'' \times 4''$ battens placed $6''$ from c.
 $W=.75$ for $1'' \times 6''$ battens placed $8''$ from c.
 $W=1.13$ for $6''$ to $8''$ D. and M. flooring or sheathing.
 $W=1.19$ for $4''$ D. and M. flooring or ceiling.
 $W=1.25$ for $3''$ D. and M. flooring or ceiling.
 $W=1.34$ for $2''$ D. and M. flooring.
 $W=1.75$ for $1\frac{1}{2}''$ D. and M. flooring.
 $W=1.30$ for $6''$ siding $4\frac{1}{4}$ to weather.
 $W=1.38$ for $4''$ siding $2\frac{1}{2}$ to weather.
 $W=1$. For most felts and papers as these are usually listed for enough less than the roll actually contains to allow for lapping.

LABOR.

Wages for labor are paid by the hour and are governed by union scales. Let hourly wage = $H=70c$ in Chicago at this time.

Labor required to place and finish material is usually approximated either by the time required to erect a square of surface of framing for partitions, walls, floors, or of layers of covering, or by the time required to place one M bd. ft. of material or M sq. ft. of surface in the case of sheet coverings. The latter method is the more practical and involves less work in estimating, as these quantities have to be determined in estimating the material.

The following table gives the approximate number of hours it will take an average mechanic to place one thousand (M) board feet or surface feet of material of the various sorts and for various purposes enumerated.

TABLE IV.

Framing Stuff. Hours required to place 1 M.
 $2'' \times 3''$ studs require 35 hours to place 1 M.
 $2'' \times 4''$ and $2'' \times 6''$ studs require 32 hours to place 1 M.
 $2'' \times 8''$ studs require 30 hours to place 1 M.
 $1'' \times 1''$ grounds require 83 hours to place 1 M.
 $1'' \times 2''$ grounds and furring require 64 hours to place 1 M.
 $2'' \times 2''$ grounds and furring require 50 hours to place 1 M.

$1'' \times 8''$ to $10''$ sheathing require 30 hours to place 1 M.
 $1'' \times 4''$ roof sheathing or slats require 26 hours to place 1 M.
 $1'' \times 6''$ roof sheathing or slats require 26 hours to place 1 M.
Shingles laid $4\frac{1}{2}''$ to W. require 5.8 hours to place 1 M.
1000 sq. ft. paper or felt require $\frac{3}{4}$ hours to place 1 M.
 $1'' \times 8''$ and $1'' \times 6''$ D. & M. sheathing require 25 hours to place 1 M.
 $1'' \times 4''$ D. & M. sheathing require 26 hours to place 1 M.
 $2'' \times 4''$ and $2'' \times 6''$ D. & M. sheathing require 20 hours to place 1 M.
 $3'' \times 4''$ D. & M. sheathing require 14 hours to place 1 M.
 $3'' \times 6''$, $3'' \times 8''$, $4'' \times 4''$ and $4'' \times 6''$ D. & M. sheathing require 16.6 hours to place 1 M.
 $4'' \times 8''$ D. & M. sheathing require 15 hours to place 1 M.
 $1'' \times 1\frac{1}{2}''$ and $1'' \times 2''$ D. & M. hardwood flooring require 66 hours to place 1 M.
 $1'' \times 3''$ D. & M. hardwood flooring require 58 hours to place 1 M.
 $1'' \times 4''$ D. & M. hardwood flooring require 53 hours to place 1 M.
 $1\frac{1}{4}'' \times 2''$ D. & M. hardwood flooring require 63 hours to place 1 M.
 $1\frac{1}{4}'' \times 3''$ D. & M. hardwood flooring require 60 hours to place 1 M.
 $2'' \times 4''$ and $2'' \times 6''$ rafters require 33 hours to place 1 M. bd. ft.
 $2'' \times 8''$ rafters require 30 hours to place 1 M. bd. ft.
 $2'' \times 6''$ and $2'' \times 8''$ joists require 25 hours to place 1 M. bd. ft.
 $2'' \times 10''$ joists require 21.5 hours to place 1 M. bd. ft.
 $2'' \times 12''$ and $2'' \times 14''$ joists require 20 hours to place 1 M. bd. ft.
 $3'' \times 8''$ and $3'' \times 10''$ joists require 20 hours to place 1 M. bd. ft.
 $3'' \times 12''$, $3'' \times 14''$ and $3'' \times 16''$ joists require 18 hours to place 1 M. bd. ft.
 $4'' \times 8''$ and $4'' \times 10''$ joists require 20 hours to place 1 M. bd. ft.
 $4'' \times 12''$ and $4'' \times 14''$ joists require 18.7 hours to place 1 M. bd. ft.
 $4'' \times 16''$ joists require 16.7 hours to place 1 M. bd. ft.
 $6'' \times 6''$ joists require 20 hours to place 1 M. bd. ft.
 $6'' \times 8''$ and $6'' \times 10''$ joists require 18.7 hours to place 1 M. bd. ft.
 $6'' \times 12''$ and all stuff up to $16'' \times 16''$ for joists require 16.7 hours to place 1 M.
 $4'' \times 4''$ posts require 23 hours to place 1 M. bd. ft.
 $6'' \times 6''$ posts require 20 hours to place 1 M. bd. ft.
 $8'' \times 8''$ posts require 18 hours to place 1 M. bd. ft.
 $10'' \times 10''$, $12'' \times 12''$, $14'' \times 14''$ and $16'' \times 16''$ posts require 16.7 hours to place 1 M. bd. ft.

TRIM OR FINISH.

It is impossible to give any accurate idea of the amount of time required to do this class of work, there are so many conditions that enter into consideration that can not be stipulated in a table.

Openings require in labor to put in blocks, set jambs or frames, place trim, hang doors or windows and put on hardware from 6 to 12 hours, but average in all sorts of work and buildings about 9 hours.

Baseboard, one member, 1000 lin. ft. requires 50 hours to place.

Baseboard, two members, 1000 lin. ft. requires 66 hours to place.

Baseboard, three member, 1000 lin. ft. requires 83 hours to place.

Plate-shelf, 3 part, consisting of shelf, apron and mould, 1000 lin. ft. requires 100 hours to place; add 1-6 hour for each bracket.

Wainscoting, plain beaded D. & M., requires 23 hours to place 1 M. bd. ft.
Paneled Wainscoting from 2' to 4' 6" high requires about 83 hours to place 1000 lin. ft.
Picture Moulding requires about 33 hours to place 1000 lin. ft.
Ceiling Beams, consisting of blocks, 3 sides and 2 to 4 mouldings, require about 250 hours to place 1000 lin. ft.
Seat with back and sides requires about 8 hours to place.

THE ESTIMATE.

The estimate at best can be little more than an intelligent guess based on past experience. One can never be sure that the same conditions will prevail in the job to be executed as have prevailed in the one just completed. No attempt has been made to suggest a method of estimating cost of interior trim or exterior cornice frames, etc.

Estimated Cost of Rough Work, Floors and Roofs = [(J taken from Table 1 × N, taken from Table IV × union wages per hour, taken from union scale governing in the locality) + J × (price per M of material, obtained

from material dealer at the time of making estimate) + (the following for each layer of covering) $\left(\frac{9W}{1000} \right)$ taken from Table III
 \times price per M of material) + $\left(\frac{100W}{1000} \times N \times H \right)$
times the number of squares of this sort of construction contained in the building.

Estimate for partition work, proceed in same manner as for floor, only substitute from proper table.

Example—Estimate the cost of a 2" x 4" stud partition 11 ft. high and 137 ft. long broken around various rooms and having studs placed 16" from centers and 1" x 1" grounds.

Area = 137 × 11 = 1507 sq. ft. = 15.07 squares. Q = .11027 from Table II, Col. IV, Dealer's price per M = \$25.00, N 2" x 4" studs from Table IV = .5 hr. H = \$.60. G from formulae (9.) = .00756 and N from Table IV = 2 hr.; then $[(.11027 \times \$25.00) + (.00756 \times \$26.00) + (.11027 \times .5 \times \$0.60) + (.00756 \times 2 \times \$0.60)] 15.07 =$

STANDARD MEASUREMENT TABLE FOR TIMBER. FILE 694.0

nom.	2x4	2x6	2x8	2x10	2x12	3x4	3x6	3x8	3x10	3x12	3x14	4x4	4x6	4x8	4x10	4x12	5x8	5x10	5x12	5x14	5x16	5x18	5x20	5x22	5x24	5x26	5x28	5x30	5x32	5x34	5x36	5x38	5x40	5x42	5x44	5x46	5x48	5x50	5x52	5x54	5x56	5x58	5x60	5x62	5x64	5x66	5x68	5x70	5x72	5x74	5x76	5x78	5x80	5x82	5x84	5x86	5x88	5x90	5x92	5x94	5x96	5x98	5x100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
6	4	6	8	10	12	14	6	9	12	15	18	21	8	12	16	20	24	18	24	30	36	32	40	48	50	60	70	72																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

OVERLAYING CONSTRUCTION SHEET, SHINGLE AND COMPOSITION COVERING.

FILE 695.1

The average width of a shingle is four inches. Hence, when shingles are laid four inches to the weather each shingle averages 16 square inches, and 900 are required for a square of roofing (100 square feet). If $4\frac{1}{2}$ inches to the weather, 800; 5 inches, 720; $5\frac{1}{2}$ inches, 655; 6 inches, 600.

Slating.

FILE 695.2

Slating is estimated by the "square," which is the quantity required to cover 100 square feet. The slates are usually laid so that the third laps the first three inches.

Number of Slates per Square.

Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.
6 × 12	533	8 × 16	277	12 × 20	141
7 × 12	457	9 × 16	246	14 × 20	121
8 × 12	400	10 × 16	221	11 × 20	137
9 × 12	355	9 × 18	213	12 × 22	126
7 × 14	374	10 × 18	192	14 × 22	108
8 × 14	327	12 × 18	160	12 × 24	114
9 × 14	291	10 × 20	169	14 × 24	98
10 × 14	261	11 × 20	154	16 × 24	86

The weight of slate per cubic foot is about 174 pounds, or per square foot of various thicknesses as follows:

Thickness in inches.....	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$
Weight in pounds.....	1.81	2.71	3.62	5.43	7.25

The weight per square foot of roof tiling, set in iron or between wood rafters ready for slating, is about 12 pounds.

Tin Roofs.

FILE 695.4

Tin roofs should be laid with cleats.

There are two kinds of tin—"bright tin," the coating of which is all tin, that is, the tin proper; and "tern," "leaded," or "roofing" tin, the coating of which is a composition, part tin and part lead. This last will not rust any quicker, but the sulphur in soft coal smoke eats through the "leaded" coating sooner than through the "tinned."

Sizes of tin, 10 by 14 and 14 by 20, and two grades of thickness—IC light, and IX, heavy. For a steep roof (one-sixth pitch or over) the IC 14 by 20 tin ("leaded" if high up where little smoke will get to it; "bright" if low down), put on with a standing groove, and with the cross seams put together with a double lock, makes as good a roof as can be made. For flat roofs IX 10 x 14 "light" is best, laid with cleats, but the others make good roofs and any of them will last twenty-five years at least, if painted periodically.

Number of Square Feet a Box of Roofing Tin Will Cover.—For flat seam roofing, using $\frac{1}{2}$ -inch locks, a box of "14 by 20" size will cover about 192 square feet, and for standing seam, using $\frac{3}{8}$ -inch locks and turning $1\frac{1}{4}$ and $1\frac{1}{2}$ inch edges, making 1-inch standing seams, it will lay about 168 square feet.

For flat seam roofing, using $\frac{1}{2}$ -inch locks, a box of "28 by 20" size will cover about 399 square feet, and for standing seam, using $\frac{3}{8}$ -inch locks and turning $1\frac{1}{4}$ and $1\frac{1}{2}$ inch edges, making 1-inch standing seams, it will lay about 365 square feet.

Every box of roofing plates (IC or IX "14 by 20" or "28 by 20" sizes) contains 112 sheets.

For roofs and gutters use seven-pound lead; for hips and ridges, six-pound; for flashings, four-pound.

Gutters should have a fall of at least one inch in ten feet.

No sheet lead should be laid in greater length than ten or twelve feet without a dip to allow for expansion.

Joints to lead pipes require a pound of solder for every inch in diameter.

SANITARY AND ELECTRIC POWER EQUIPMENT

INCLUDING PLUMBING, ILLUMINATION AND ELECTRIC POWER

Capacity of Cisterns.

FILE 698

For a circular cistern, square the diameter and multiply by .7854, for the area; multiply this by 1,728 and divide by 231, for number of gallons of one foot in depth; for a square cistern, multiply length by breadth, and proceed as above.

CIRCULAR CISTERN.

5 feet in diameter holds 4.66 bbls.
6 feet in diameter holds 6.71 bbls.
7 feet in diameter holds 9.13 bbls.
8 feet in diameter holds 11.93 bbls.
9 feet in diameter holds 15.10 bbls.
10 feet in diameter holds 18.65 bbls.

SQUARE CISTERN.

5 feet by 5 feet holds 5.92 bbls.
6 feet by 6 feet holds 8.54 bbls.
7 feet by 7 feet holds 11.63 bbls.
8 feet by 8 feet holds 15.19 bbls.
9 feet by 9 feet holds 19.39 bbls.
10 feet by 10 feet holds 23.74 bbls.

Wrought-iron Welded Pipe.

DIMENSIONS, WEIGHTS, ETC., OF STANDARD SIZES FOR STEAM, GAS, WATER, OIL, ETC.

Inside Diameter	Outside Diameter	External Circumference, A	Length of Pipe per Sq Foot of Outside Surface.	Internal Area	External Area.	Length of Pipe containing one Cubic Foot.	Weight per Foot of Length	No. of Threads per Inch of Screw.	Contents in *Gallons per Foot.	Weight of Water per Foot of Length.
In.	In.	In.	Ft.	In.	In	Ft	Lbs.			Lbs
1/8	.40	1.272	9.44	.012	.129	2,500	.24	27	.0006	.005
1/4	.54	1.656	7.075	.049	.229	1,385	.42	18	.0026	.021
3/8	.67	2.121	5.657	.110	.358	751.5	.56	14	.0057	.047
1/2	.84	2.662	4.502	.196	.554	472.4	.84	14	.0102	.085
3/4	1.05	3.299	3.637	.441	.866	270.	1.12	11 1/2	.0230	.190
1	1.31	4.134	2.903	.755	1.357	166.9	1.67	11 1/2	.0468	.349
1 1/4	1.66	5.215	2.301	1.227	2.104	96.25	2.25	11 1/2	.0638	.527
1 1/2	1.9	5.959	2.01	1.767	2.835	70.65	2.60	11 1/2	.0918	.760
2	2.37	7.461	1.611	3.141	4.330	42.36	3.66	8	.1632	1.358
2 1/2	2.87	9.032	1.328	4.905	6.491	30.11	5.77	8	.2580	2.116
3	3.5	10.996	1.091	7.068	9.621	19.49	7.54	8	.3673	3.049
3 1/2	4	12.566	.955	9.621	12.566	14.59	9.95	8	.4995	4.155
4	4.5	14.137	.849	12.566	15.904	11.31	10.72	8	.6525	5.498
4 1/2	5.	15.708	.765	15.904	19.635	9.03	12.49	8	.8263	6.851
5	5.56	17.475	.629	19.635	24.299	7.20	14.56	8	1.020	8.500
6	6.62	20.813	.577	28.274	34.471	4.95	18.76	8	1.460	12.312
7	7.62	23.954	.505	35.454	45.663	3.72	23.41	6	1.999	16.662
8	8.62	27.096	.444	50.265	58.426	2.88	28.34	6	2.611	21.750
9	9.68	30.433	.394	63.617	73.715	2.26	34.67	8	3.300	27.500
10	10.75	33.772	.355	78.540	90.792	1.80	40.04	8	4.081	34.000

* The Standard U. S. gallon of 231 inches.

Divide the external circumference column, A, by 12 and the result will be the square feet of surface per lineal foot

Grade Per Mile.

The following table will show the grade per mile:

An inclination of

1 foot in 15 is 352 feet per mile.	1 foot in 40 is 132 feet per mile.
1 foot in 20 is 264 feet per mile.	1 foot in 50 is 106 feet per mile.
1 foot in 25 is 211 feet per mile.	1 foot in 100 is 53 feet per mile.
1 foot in 30 is 176 feet per mile.	1 foot in 125 is 42 feet per mile.
1 foot in 35 is 151 feet per mile.	

To find quantity of water elevated in one minute running at 100 feet of piston speed per minute: Square the diameter of the water cylinder in inches and multiply by 4. Example: Capacity of a 5-inch cylinder is desired. The square of the diameter (5 inches) is 25, which, multiplied by 4, gives 100, the number of gallons per minute (approximately).

Quantity of Brickwork in Barrel Drains and Wells.

Diameter in Clear	Thickness of Brickwork	Superficial Feet of Brickwork in One Linear Yard.	Number of Bricks Required for One Linear Yard
1 foot, 0 inches	0 feet, 4½ inches	16 feet, 6 inches	115
1 " 6 "	0 " 4½ "	21 " 2 "	148
2 " 0 "	0 " 4½ "	25 " 10 "	181
2 " 6 "	0 " 9 "	33 " 0 "	462
2 " 6 "	0 " 9 "	37 " 8 "	528
2 " 6 "	1 " 1 "	43 " 2 "	906
3 " 0 "	0 " 9 "	42 " 6 "	594
3 " 0 "	1 " 1 "	47 " 10 "	1004
3 " 6 "	0 " 9 "	47 " 1 "	659
3 " 6 "	1 " 1 "	52 " 7 "	1104
4 " 0 "	0 " 9 "	51 " 10 "	725
4 " 0 "	1 " 1 "	57 " 3 "	1203
5 " 0 "	0 " 9 "	61 " 3 "	857
5 " 0 "	1 " 1 "	66 " 9 "	1402
6 " 0 "	1 " 1 "	76 " 1 "	1597
7 " 0 "	1 " 1 "	85 " 6 "	1795

Tests for Pure Water.

Color: Fill a clean long bottle of colorless glass with the water; look through it at some black object. It should look colorless and free from suspended matter. A muddy or turbid appearance indicates soluble organic matter or solid matter in suspension. **Odor:** Fill the bottle half full, cork it, and leave it in a warm place for a few hours. If when uncorked it has a smell the least repulsive, it should be rejected for domestic use. **Taste:** If water at any time, even after heating, has a disagreeable taste, it should be rejected.

A simple semi-chemical test is known as the "Heisch test." Fill a clean pint bottle three-fourths full of the water; add a half-teaspoonful of clean granulated or crushed loaf sugar; stop the bottle with glass or a clean cork and let it stand in a light and moderately warm room for forty-eight hours. If the water becomes cloudy, or milky, it is unfit for domestic use.

Capacity of Drain Pipe.

SIZE OF PIPE.	GALLONS PER MINUTE.							
	3-in. Fall, per 100 ft.	3-in. Fall, per 100 ft.	6-in. Fall, per 100 ft.	9-in. Fall, per 100 ft.	12-in. Fall, per 100 ft.	18-in. Fall, per 100 ft.	24-in. Fall, per 100 ft.	36-in. Fall, per 100 ft.
3-inch	21	30	42	52	60	74	85	104
4 "	36	52	76	92	108	132	148	184
6 "	84	120	169	206	240	294	338	414
9 "	232	330	470	570	660	810	930	1140
12 "	470	680	960	1160	1360	1670	1920	2350
15 "	830	1180	1680	2040	2370	2920	3340	4100
18 "	1300	1850	2630	3200	3740	4600	5270	6470
20 "	1760	2450	3450	4180	4860	5980	6850	8410

Table showing the velocity of discharge of different sized sewers.

Diam. of pipe.	180 feet per minute, 3 feet per second.		270 feet per minute, 4½ feet per second.		360 feet per minute, 6 feet per second.		540 feet per minute, 9 feet per second.	
	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.
3	1 in 69	54	1 in 30.4	81	1 in 17.2	108	1 in 7.6	162
4	1 in 92	96	1 in 40.8	144	1 in 23.	192	1 in 10.2	288
6	1 in 138	216	1 in 61.2	324	1 in 34.5	432	1 in 15.3	648
9	1 in 207	495	1 in 92.	742.5	1 in 51.7	990	1 in 23	1,485

HEATING VENTILATION AND STEAM POWER.

Hot-Water and Steam Heating—Overhead System.

FILE 697.41

In using steam for the heating of high buildings, it is necessary to use the overhead plan, unless some automatic system of expelling the air is adopted. It requires less power to force the air through the standpipe than it would through a large number of risers. The air is forced out on the descent of the steam, and less fuel and power are necessary.

The overhead hot-water system is coming into general use, as it can be put in so that the farthest radiators in a building will heat at the same time as those nearer the boiler, and the result will also be felt in rooms in the basement—the principle of the siphon causing the effect.

The pipes from the main in the attic, from which the several branches are taken, can be pitched so that heat in the several parts of a building will result as quickly as desired; either an open or closed tank can be used. The pipes exposed in attic should be covered. Opinions vary as to the sizes of pipe to be used.

List of Sizes of Steam Mains.

FILE 697.42

To determine the size of pipes no fixed rule can be given which will apply in all cases. A rule that has generally been accepted by steam fitters as good practice, is to allow the area of a one-inch pipe (.7854 square inches) for every 100 square feet of radiating surface, including mains.

BOILER EFFICIENCY TABLE
Based on evaporation from and at 212° F.

B. T. U. Per Lb. Coal.	50% Efficiency		55% Efficiency		60% Efficiency		65% Efficiency		70% Efficiency		75% Efficiency		80% Efficiency	
	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.
7500	3.8	9.0	4.2	8.2	4.6	7.5	5.0	6.8	5.4	6.4	5.8	6.0	6.2	5.5
8000	4.1	8.4	4.5	7.6	4.9	7.0	5.3	6.5	5.7	6.0	6.2	5.5	6.6	5.2
8500	4.4	7.8	4.8	7.1	5.2	6.6	5.7	6.0	6.1	5.6	6.6	5.2	7.0	4.9
9000	4.6	7.5	5.1	6.7	5.5	6.2	6.1	5.5	6.5	5.3	6.9	5.0	7.4	4.6
9500	4.9	7.0	5.4	6.3	5.9	5.8	6.3	5.4	6.8	5.0	7.3	4.7	7.8	4.4
10000	5.1	6.7	5.6	6.1	6.2	5.5	6.7	5.1	7.2	4.7	7.7	4.4	8.2	4.2
10500	5.4	6.3	5.9	5.8	6.5	5.3	7.1	4.8	7.6	4.5	8.1	4.2	8.6	4.0
11000	5.6	6.1	6.2	5.5	6.8	5.0	7.4	4.6	7.9	4.3	8.5	4.0	9.1	3.7
11500	5.9	5.8	6.5	5.3	7.1	4.8	7.7	4.4	8.3	4.1	8.9	3.8	9.5	3.6
12000	6.2	5.5	6.8	5.0	7.4	4.6	8.0	4.3	8.6	4.0	9.3	3.7	9.9	3.4
12500	6.4	5.3	7.1	4.8	7.7	4.4	8.4	4.1	9.0	3.8	9.7	3.5	10.3	3.3
13000	6.7	5.1	7.4	4.6	8.0	4.3	8.7	3.9	9.4	3.6	10.0	3.4	10.7	3.2
13500	6.9	5.0	7.6	4.5	8.3	4.1	9.0	3.8	9.7	3.5	10.4	3.3	11.1	3.1
14000	7.2	4.7	7.9	4.3	8.6	4.0	9.4	3.6	10.1	3.4	10.8	3.2	11.5	3.0
14500	7.5	4.6	8.2	4.2	9.0	3.8	9.7	3.5	10.5	3.2	11.2	3.0	12.0	2.8

SPACE OCCUPIED BY FUEL.

Coals of the same size coming from different mines vary in density, but the space given below is an average for best fuels:

Stove Anthracite	33	cubic feet per 2,000 lbs.
Egg Anthracite	32.5	cubic feet per 2,000 lbs.
Soft Coal	40	cubic feet per 2,000 lbs.
Coke	68	cubic feet per 2,000 lbs.

Transmission of Heat by Various Substances.

FILE 697.9

Window glass being.....	1,000	Brick (rough)	200 to 250
Oak or Walnut.....	66	Brick Whitewashed	200
White Pine	80	Granite or Slate.....	250
Pitch Pine	100	Sheet Iron	1,030 to 1,110
Lath and Plaster.....	75 to 100		

Table Showing Amount of Glass Surface which may be Heated by 1 Square Foot of Radiating Surface in Good Buildings.

Temperature of radiating surface (radiators) Fahr.....	Hot Water.			Steam.	
	160°	180°	200°	227° 5 Lbs.	240° 10 Lbs.

Square Feet of Glass to 1 Square Foot Radiator Surface.

Temperature above surrounding air 90°	1.9	2.3	2.8	3.3	3.8
" " " " 80°	2.3	2.9	3.5	4.0	4.6
" " " " 70°	3.0	3.6	4.2	5.0	5.7
" " " " 60°	4.0	4.6	5.25	6.0	7.0
" " " " 50°	5.0	6.0	6.8	8.0	9.0
" " " " 40°	6.9	8.0	8.2	10.0	11.5

Formulae for Figuring Radiation for Factories.

A formula for figuring radiation which is used by some of the best heating engineers in determining the amount of radiation for factory buildings is as follows: $\frac{G}{3.3} + \frac{W}{10.9} + \frac{V}{171} =$ sq. ft. of radiation in which, G = Glass Area.
W = Net Wall Area.
V = Volume of air in the Room.

SIZE OF STANDARD FLUE LINING ON SALE ON THIS MARKET.

Outside size.	Inside size.	Inside area.
4 1/4 x 8 1/2 in.	3 1/8 x 7 1/4 in.	22.6 sq. in.
8 1/2 x 8 1/2 in.	7 x 7 in.	49 sq. in.
13 x 13 in.	11 5/8 x 11 5/8 in.	135 sq. in.
4 1/2 x 13 in.	3 1/8 x 11 5/8 in.	36.5 sq. in.
8 1/2 x 13 in.	6 5/8 x 11 5/8 in.	77 sq. in.
13 x 18 in.	11 1/2 x 16 3/4 in.	193 sq. in.
8 1/2 x 18 in.	6 7/8 x 16 1/2 in.	114 sq. in.
18 x 18 in.	15 3/4 x 15 3/4 in.	247 sq. in.

GENERAL RULE FOR BRICK STACKS.

Diameter of base should not be less than 1 1/10 of height if square, or round, 1/12 of height. Batter of stacks 3/100 of an inch to the foot in height. Thickness of brick work should be not less than one brick from top to 25 feet below same, changing to 1 1/2 brick from 25 feet to 50 feet below top, increasing

1/2 brick in thickness for each succeeding 25 feet, measuring from the top downward.

Fireplace Flue Areas.

For three-story building, area at top of smoke chamber should be 1/12 of area of fireplace opening.

Two-story building area at top of smoke chamber should be 1/10 of area of fireplace opening.

One-story building area at top of smoke chamber should be 1/8 area of fireplace opening.

Throat of fireplace should never be less than 3 in. or more than 4 1/2 in. by the width of fireplace opening.

Front edge of arch should never be thicker than one-half brick, approximately 4 in.

Splay of sides of flue from throat opening up to flue lining should be 2 in. to the foot. The raise from soffit or lintel, or from highest point or soffit to arch should be 6 in.

Proportion of Parts of Steam Heating Boilers.

FROM PROF. R. C. CARPENTER.

FILE 697.43

Radiating surface—square feet.....	250	500	750	1000	1500	2000	3000	4000	5000	7500	10000
Nominal horse-power.....	2.5	5.0	7.5	10.0	15.0	20.0	30.0	40.0	50.0	75.0	100.0
Ratio radiating to heating surface.....	4.5	5.1	5.4	5.6	6.0	6.2	6.7	6.9	7.0	7.0	7.0
Probable evaporation per lb. coal.....	5.5	5.7	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
Pounds of steam per sq. ft. grate (A).....	55.0	57.0	60.0	65.0	70.0	75.0	80.0	85.0	90.0	95.0	100.0
Pounds of steam per sq. ft. grate (B).....	44.0	46.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Ratio radiating to grate surface (A).....	165.0	171.0	180.0	195.0	210.0	225.0	240.0	255.0	270.0	285.0	300.0
Ratio radiating to grate surface (B).....	132.0	138.0	141.0	156.0	168.0	180.0	192.0	204.0	216.0	228.0	240.0
Ratio heating to grate surface (A).....	36.5	33.2	33.2	34.8	35.0	36.2	36.5	37.0	38.5	40.5	42.5
Ratio heating to grate surface (B).....	28.5	27.0	26.7	27.7	28.0	29.0	29.3	29.6	30.8	32.2	34.5
Heating surface, square feet.....	55.0	98.0	138.0	178.0	250.0	322.0	447.0	580.0	710.0	1071	1430
Grate surface, square feet (A).....	1.52	2.92	4.15	5.68	7.15	8.9	12.4	15.7	18.5	26.5	33.3
Grate surface, square feet (B).....	1.88	3.88	5.4	6.37	8.92	11.2	15.5	19.5	23.2	32.5	41.5
Diameter of safety valve, inches.....	1.5	2.25	2.50	2.75	3.0	3.25	3.5	4.2	4.0	2 of 4	2 of 4
Diameter of smoke flues, inches.....	7.0	10.0	11.2	12.0	15.0	17.0	19.0	23.0	25.0	28	3A
Square inches in above flues.....	38.5	78.5	95.0	113.0	176.7	227.0	283.5	415.5	490.9	615.7	907.9

* Water tube boilers.

A When rate of coal consumption is 10 pounds per hour each square foot grate surface.

B When rate of coal consumption is 8 pounds per hour each square foot grate surface.

THE ORDERS AND THEIR APPLICATION.

By ALFRED W. S. CROSS, M. A., F. R. I. B. A., and ALAN E. MUNBY, M. A.

Introduction.

So many scholarly works upon the Orders are in existence, that some explanation seems to be called for in introducing another series of articles upon a subject that is, to all appearances, already well worn.

Notwithstanding the consensus of opinion as to the general proportions that ought to be followed in their delineation, an opinion based upon the rules laid down by the architects of an early period of the Renaissance, a surprising divergence from the precepts and practices of these old masters of their art is to be found in many buildings of our own time.

The writers are only aware of the existence of one book which seems to meet the usual office requirements, and that is a work entitled: "Rules for Drawing the Several Parts of Architecture," by James Gibbs, published in 1732: a book that has never been reprinted and copies of which are not now readily obtainable. The object aimed at, and successfully attained, is an illustration and description of an example of each Order, not "after Gibbs," but representing one of a good average type of design so proportioned that the dimensions of the various parts bear simple and easily discernible ratios one to another.

An attempt has been made to co-ordinate the leading features of the book by re-drawing some of the illustrations, retaining the useful dimensions shown thereon and entirely re-writing the description of the plates, with the introduction of some general principles likely to be of value to the draughtsman and student, for which purpose the opinions of standard writers, particularly those of Sir William Chambers, have been freely incorporated.

Before attempting such a condensation of the material in the book it was thought desirable to ascertain how far the generalizations adopted by Gibbs really represent the proportions used by acknowledged authorities. For this purpose the average ratio of the diameter of the column to the height of the entablature, as being a relation which essentially affects the whole proportion of the Order, was obtained by measuring a number of recognized examples, and it may be of interest to give the results, as an indication of the actual value of the dimensions used.

The result renders it evident that the general proportions of the Orders as recommended for adoption by this architect are fully worthy of confidence.

Hence, it would obviously seem preferable to master a few main dimensions, and, having thus inculcated a general sense of proportion, to rely upon gaining familiarity with the plates by constant use, when the proportions of the smaller members of the compositions will become naturally assimilated. The Composite Order is given in Gibbs' book, but, owing to its similarity to the Corinthian and to the absence of a consensus of opinion as to its dimensions, it has not been included in the present work.

No encroachments have been shown on any of the Orders to avoid distracting attention from the dimensions. With the exception of the whole of the Tuscan Order and of the frieze of the Ionic Order there are few members, apart from mere fillets, which have not been enriched, by some form of ornament, in one or another example, the Doric naturally the least and the Corinthian the most. In the latter Order, in fact, even the cyma and corona of the cornice, in addition to the frieze, ogees and beads, are often ornamented, but, apart from the question of expense, it is undesirable to carry such elaboration too far, as when placed in close contact with each other, especially when a distant view is alone possible, one moulding will often rob another of its effect, and, indeed, the value of richness of detail is more often than not lost in this manner.

The enrichment of columns beyond ordinary flutings is generally to be deprecated, while the application of ornament to bases and pedestals is seldom either requisite or desirable.

However great may be the utility of drawings dealing with the Orders, it should never be forgotten that they are merely a means to an end, that end being an executed building. Those whose work is confined to a drawing board develop a strong tendency to consider their compositions solely from an elevational and artistic draughtsman's point of view, and every opportunity should be taken of checking this habit and of cultivating the art of thinking "in the round." The study of per-

TABLE SHOWING THE APPROXIMATE RATIO BETWEEN THE LOWER DIAMETER OF THE COLUMN AND THE HEIGHT OF THE ENTABLATURE.

Tuscan.	Doric.	Ionic.	Corinthian.
Alberti .....1:1.5	Alberti .....1:2.0	Alberti .....1:1.4	Alberti .....1:1.8
Palladio .....1:1.8	Palladio .....1:1.9	Palladio .....1:1.7	Palladio .....1:2.0
Scamozzi .....1:1.9	Scamozzi .....1:2.1	Palladio .....1:2.0	Scamozzi .....1:2.0
Vignola .....1:1.8	Vignola .....1:2.0	Scamozzi .....1:1.8	Vignola .....1:2.5
—	Parthenon .....1:2.0	Vignola .....1:2.3	Pantheon .....1:2.3
—	Baths, Diocletian 1:2.0	Fortuna (Rome) 1:2.3	Jupiter Stator 1:2.5
—	Temple Pestum 1:1.7	Minerva, Athens 1:2.3	Temple Antonius 1:2.3
St. Paul's Convent	Apollo, Delos 1:1.8	Illus, Athens 1:2.3	
Garden 1:1.8	Bow Church,	Banqueting Hall 1:2.0	Hampden Court 1:2.2
	Portico .....1:1.9		
Average .....1:1.76	Average .....1:1.93	Average .....1:2.00	Average .....1:2.00
Gibbs .....1:1.75	Gibbs .....1:2.00	Gibbs .....1:1.82	Gibbs .....1:2.00

The above examples have not been selected with any intention of justifying the proportions adopted by Gibbs, but are merely cited as those which readily occurred to the mind, or of which the dimensions could be easily obtained.

spective of buildings, and, best of all, the preparation of models of portions of a proposed building, an occupation which often results in the discovery of latent defects of design, are alike of the greatest educational value to the student of architecture.

THE SETTING UP OF AN ORDER.

(To be studied in connection with Plates I., II., III., IV. and V.)

The sequence followed in setting up an Order will be found to influence, to some extent, the rapidity and facility with which it can be accomplished. An outline of the method of procedure may, therefore, prove useful.

Usually the height of the Order is fixed by circumstances, as, for example, when it is to be applied to a given story of a building.

The total height having been settled, draw the limiting horizontal lines and then set out the vertical centre lines of the columns, thus dividing the frontage to be treated into bays appropriate to the exigencies of the design and having due regard to the correct intercolumniation of the Order adopted. If a pedestal is to be placed under the column, cut off one-fifth of the total height for it, and cut off one-fifth or one-sixth of the remainder (measured from the top limiting horizontal line) for the vertical height of the entablature; the intervening space gives the height of the column, including its cap and base. If no pedestal is to be used, divide the whole of the given height into five or six parts, cut off one of these parts, from the top, for the entablature, and the remainder gives the height of the column.

The Column. Since some of the dimensions of the entablature are in terms of the diameter of the column, the latter should be next developed. The term "diameter of the column" refers always to its greatest diameter—namely, that of the shaft just above the lower cincture. This dimension is one-seventh to one-tenth of the height between the soffit of the entablature and the top of the pedestal, or lower limit of the Order in the absence of a pedestal. If the centre lines of the piers do not represent the centres of the columns, as, for instance, when coupled columns are used, the centre line of one of the columns must now be decided upon and the diameter of the Order symmetrically disposed horizontally across it. A semi-diameter is then cut off, from the bottom of the column, for the height of the base, and it should be noticed that this—except in the Tuscan and alternative Doric Orders—does not include the fillet at the base of the shaft, the members above the upper torus being reckoned as part of the shaft, as are also the astragal and fillet below the necking of the capital of the column. The plinth and lower torus of the base project one-third and the upper torus one-fifth of a semi-diameter beyond the lower circumference of the shaft. The leading lines for the base having thus been obtained, cut off by a horizontal line the height of the capital from the top of the column, and (except in the Ionic Order) again below it, a height equal to one-sixth of a semi-diameter for the astragal and fillet below the necking.

The semi-diameter of the shaft at one-third of its height from the bottom is then divided into five or six parts, and four or five of these parts are taken as a semi-diameter at the top, below the astragal. The shaft may now be completed, the entasis being usually made to start from the greater diameter, one-third up the shaft, below which point it is a true cylinder until the cincture at the base is reached. This is the best method to adopt in the case of small scale drawings. Where large detailed drawings are in question the diameter may be alternatively divided at the base of the shaft instead of at one-third of

its height, and the entasis extended throughout the whole length. The completion of the shaft enables the projection of the capital to be marked off, and also that of the astragal and fillet, which is equal to their combined height.

The Entablature. The development of the entablature can now be proceeded with, the architrave, frieze and cornice being ruled off horizontally and the members of each inserted (see dimensions). The projections for a returned end or section are obtained from the upper diameter of the shaft. The lowest member of the architrave, and also the frieze, lie vertically over the circumference of this upper end of the shaft. The projection of the cornice beyond the frieze line is equal to its height, except in the Doric Order, in which the projection is one-third more than its height of one diameter. Further rules dealing with minor projections and the position of the modillions, dentils, etc., will be supplied by a study of the plates and tabulated dimensions.

Pedestal. Finally, the pedestal, if any, should be divided vertically into four parts; the lower part is ruled off for the height of the plinth, one-third of the second part for the height of the base, and one-half of the top part for that of the cap. The projection of the die is equal to that of the base of the column, and the plinth and the cap of the pedestal extends beyond this for a distance equal to the height of the base of the pedestal previously obtained.

The above dimensions will all be found in the subjoined table, which represents an endeavour to bring together, in a form suitable for reference, sufficient information to make any glaring disproportion impossible.

A few of the minor divisions are only approximations; they will, however, be found to be sufficiently accurate for any but large detail drawings, in which it is not desirable to destroy all individuality by rigorous mechanical rules.

On the left hand will be found the dimension required and, in the intermediate column the fraction for each Order of the previously ascertained unit given in the right-hand column.

Plate I.

Plate I. represents the four Orders drawn to a common vertical height.

The pedestal may or may not be required and, if used, it is to be regarded as an addition to the Order, the relative dimensions of the parts of which are not altered by its removal or introduction.

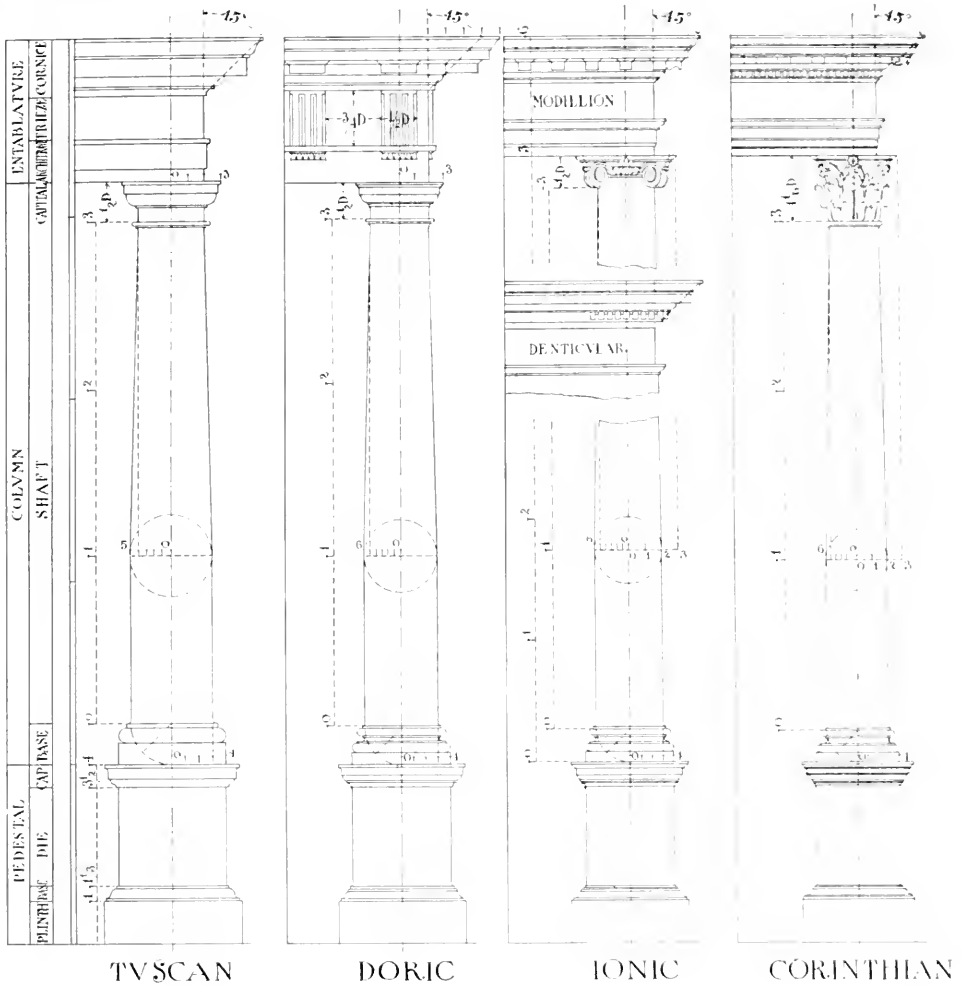
The diameter of the column (by which is meant the diameter of the shaft following its lower cincture) is the ruling dimension from which most of the others are obtained, and the smaller circumference of the top of the shaft always coincides with the frieze line from which all the projections of the entablature are set out.

In judging the value of such projections it should be borne in mind that in execution the higher vertical faces of the composition will usually be much foreshortened to the observer and that there will be a consequent increase in the comparative value of neighboring projections.

A perusal of the table will indicate those dimensions which all the Orders have in common, but for convenience of reference they are further summarized thus:

Height of Pedestal, $\frac{1}{2}$ total height of Order.

PLATE 1.



Height of Plinth, $\frac{1}{4}$ height of Pedestal.
 Height of Pedestal Base, $\frac{1}{3}$ height of Pedestal Plinth.
 Height of Pedestal Cap, $\frac{1}{2}$ height of Pedestal Plinth.
 Projection of Cap and Plinth, $\frac{1}{3}$ height of Pedestal Plinth.
 Projection of Corona over Die, $\frac{3}{4}$ projection of Pedestal Cap.
 Height of Column Base, $\frac{1}{2}$ diameter of Column.
 Projection of Base over Shaft, $\frac{1}{3}$ semi-diameter of Column.

Pilasters. The general proportions allotted to the columns of the Orders apply also to pilasters, which may be regarded as columns square on plan, but almost universally deeply engaged. The projection of pilasters must be regulated by circumstances. If impost mouldings or other projections stop upon them, as on the inner wall of an arcade, these projections must be sufficient to take the mouldings, and if they line with engaged columns crowned by an entablature, they must have a projection similar to the columns, and therefore in such cases never less than a semi-diameter. Apart from these

considerations, the projection should be about one-fourth of the diameter. Pilasters may be fluted or plain; if the former, the flutes should be, as far as possible, the same size as those of the adjoining columns, and always an odd number.

On plain faces 7 flutes (occasionally 9) are used, and therefore in the above case 4 flutes (or 5) would be employed on each side of the re-entering angle. The returned sides of pilasters should never be fluted unless the projection is as much as half a diameter. The diameter assigned to a pilaster will be that of a column (if any) used in conjunction with it. The shaft may or may not be diminished.

If the pilaster stand alone it is best formed with the same top and bottom diameter, but if a column stand in front of it then it should be diminished to the same extent as the column. Entasis is not usually given to pilasters.

Unless columns and pilasters are monoliths the shafts should be built up of three drums and not two, as a central joint, unless exceptionally well executed, has a very disagreeable appearance.

**"Practical Notes for Architectural Draughtsmen: The Orders and their Application,"
Tabulated Dimensions of the Orders, Arranged Progressively as Required for Use.**

Dimension required.		Tuscan.	Doric.	Ionic.	Corinthian.	Dimension 1.
No Pedestal	Height of Entablature	$\frac{1}{2}$	1	$\frac{1}{2}$	$\frac{1}{2}$	Total height of Order.
With Pedestal	Height of Pedestal	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " Pedestal.
THE COLUMN.						
Height of Base	Diameter of Shaft	1	1	$\frac{1}{2}$	$\frac{1}{2}$	Height of Order less Entablature and Pedestal.
" " "	Base Plinth	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Diameter of Shaft.
" " "	Lower Torus	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " less Plinth.
" " "	Upper Torus	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " lower Torus.
" " "	Upper Ionics and fillet under Capital	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " Diameter of Shaft.
" " "	Necking	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Height of Capital (Corinthian less Abacus).
" " "	Top of Neck to top of Ovolo	1	1	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Abacus	1	1	1	1	" " " " " " " "
" " "	Astragal and fillet	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Fillet below Astragal	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
Projection of Base beyond Diameter.						
" " "	Upper Torus	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Semi-diameter of Shaft.
" " "	Upper Ionics	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Height of Astragal and Fillet.
" " "	Projection of Cap over Shaft at Top	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Semi-diameter of Shaft.
" " "	Cap over Shaft at Base	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Head at top of Shaft	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Semi-diameter of Shaft at Top.
THE ENTABLATURE.						
Height of Architrave	" " "	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Semi-diameter of Shaft.
" " "	Frieze	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Cornice	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Height of Entablature.
" " "	Fillet and Cyma	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Cyma and Fillet over	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Base of Corona to top of Ovolo	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Top of Ovolo to Frieze	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
Total projection of Architrave over top diam. of Shaft						
" " "	top face of Architrave	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	of Cornice over Frieze	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Inset of Corona from top of Cornice	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Length of Modillions (or Mutules)	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Breadth of Modillions (or Dentils)	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Space between Modillions (or Dentils)	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
THE PEDESTAL.						
Height of Plinth	" " "	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Height of Pedestal.
" " "	Base	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Cyma of Base	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Fillet below Cyma	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Cap	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Base of Corona to top of Cap	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Projection of Cap and Plinth over Die	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "
" " "	Corona of Cap over Die	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" " " " " " " "

Note.—The "Diameter" is always the greatest diameter of the drum of the Column. M. refers to the Modillion Cornice. D. to the alternative Dentil Cornice.

PLATE 2.

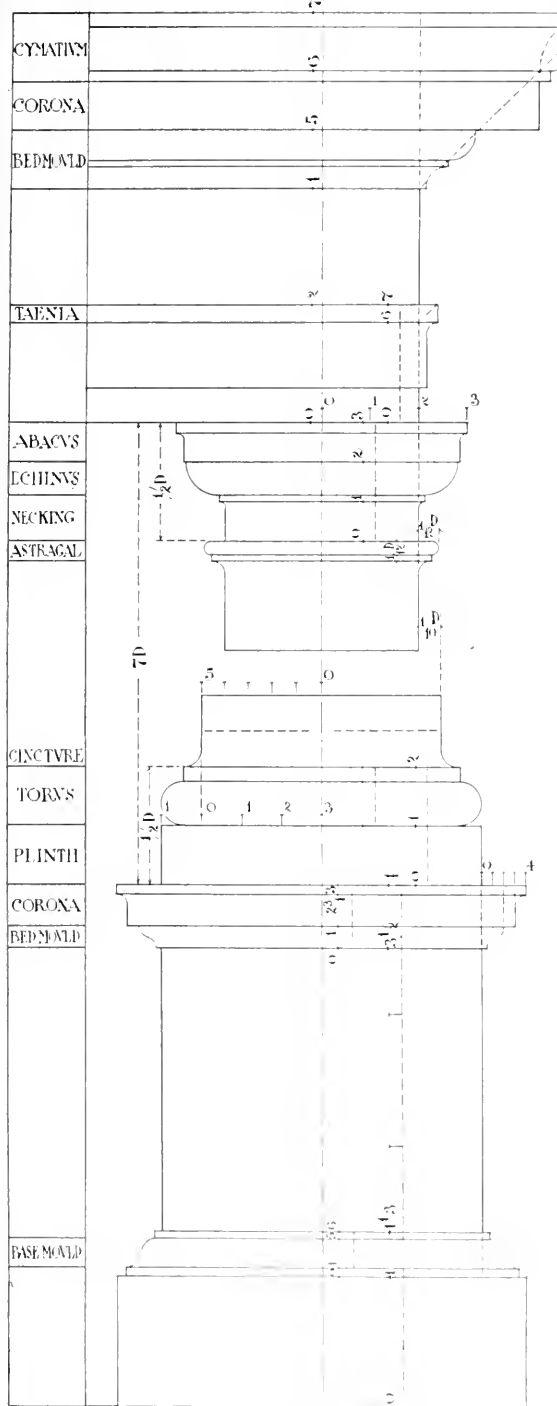


Plate II.

The Tuscan Order, though seldom used, is suitable for situations in which an appearance of strength and simplicity is required, and in which the cost of the work is an important factor. It should always be devoid of any enrichment and the unbroken character of the frieze and cornice makes it particularly useful in designs presenting awkward problems of intercolumniation.

The ratio of the dimensions of its parts is exceedingly simple. It should be noticed that the fillet below the cincture of the shaft is included in the height of the base of this Order. The projection of the cornice over the upper circumference of the column is, in this and in all Orders, except the Doric, equal to its height.

TUSCAN

PLATE 3. MUTULE CORNICE

DENTICULAR CORNICE

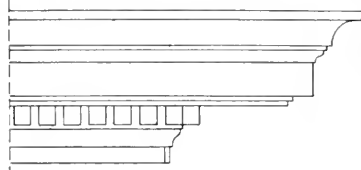
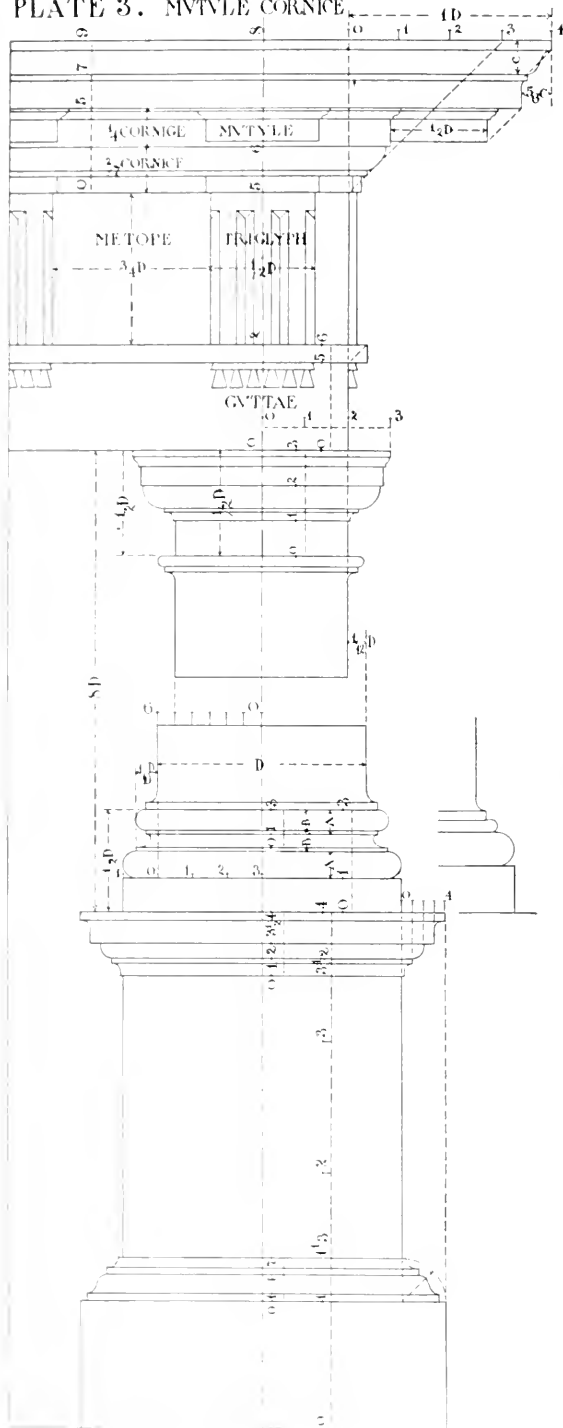


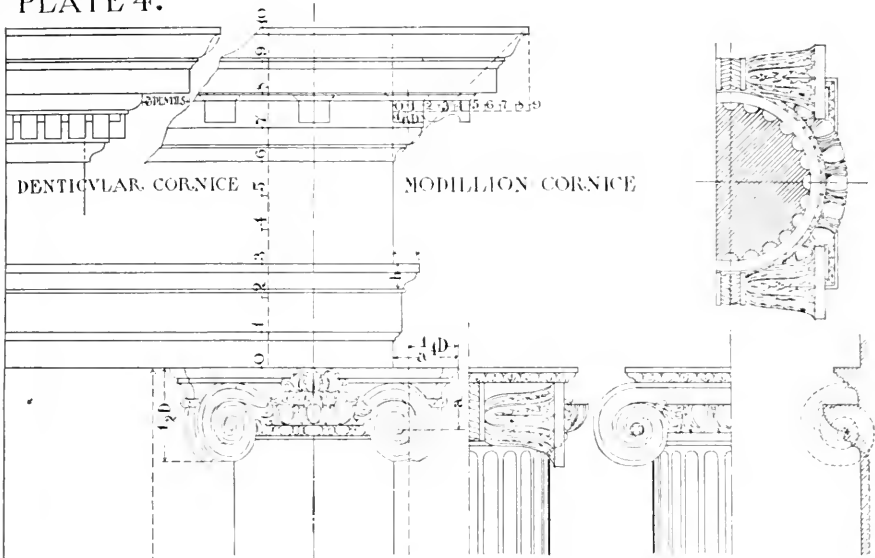
Plate III.

The Doric Order is always effective when used in lower storeys, arcades, and door and window openings, but owing to the triglyphs upon the frieze, which must fall centrally over the columns, it is the most difficult to deal with when spacing is in question.

The dimensions of the cornice do not lend themselves to any simple ratio and its projection is always greater than that adopted for the other Orders. The 45° line from the top of the frieze at once gives the bed mould of the mutule course, and one-third of the height of the cornice added to the top projection of this guiding line gives the total projection, while the mutules are one-half a diameter in side elevation. Some considerable modifications of the Order, as here represented, will be found to exist in many recognised examples. Occasionally the mutules are dispensed with, and their bed mould is cut to form a dentil course, as in the Theatre of Marcellus. The cyma crowning the cornice is often replaced by a cavetto, while the Doric base (shown alternatively on the plate) sometimes replaces the more graceful attic base. When this base is used, the upper fillet should be included in the height of the base, as in the Tuscan Order.

DORIC

PLATE 4.



CVSHION CAPITAL

Plate IV.

The **Ionic Order** shows smaller variations from the pure Classic examples than any other, and its proportions are fairly simple.

Two styles of cornices are, however, used, the modillion and the dentil cornice, and although the method adopted by Gibbs of giving prominence to the former has been followed, it should be stated that the latter is more generally found in old examples, whilst the former is preferred by Palladio.

Represented side by side upon the plate the extent of the variation is easily discernible. A modillion or dentil should always be bisected by the centre line of the column and the spacing determined by the distance of this line from the frieze, as set out upon the drawing. The frieze is always plain and in larger works it is, preferably, kept flat. In smaller compositions, however, when narrow or when used over doors and windows a pulvinated frieze may be adopted with good effect.

The earlier alternative form of the Ionic capital in which the faces of the volutes are parallel to the plane of the elevation (not shown upon the drawings) may, of course, be substituted for the capital with angle volutes at 45°, though the latter has usually a much more graceful effect, particularly in small compositions. Of course, the geometrical method for setting out the volutes cannot be used in drawing such capitals in ordinary elevation. It should be noticed that the height of the capital in this Order is measured from the soffit of the volutes.

The centre of the eye is one-third of the height of the capital from its bottom and is in elevation placed just outside the top circumference of the shaft, while the horizontal fillet at the top of the shaft is immediately below the eye.

When the column is fluted the width of the fillets should be one-fourth to one-third that of the flutes. The flutes generally number twenty or twenty-four; in the latter case the simple method of setting them out on plan, as shown on the drawing, will be found of service.

The attic base is always used with the Ionic Order.

IONIC

PLATE 5.

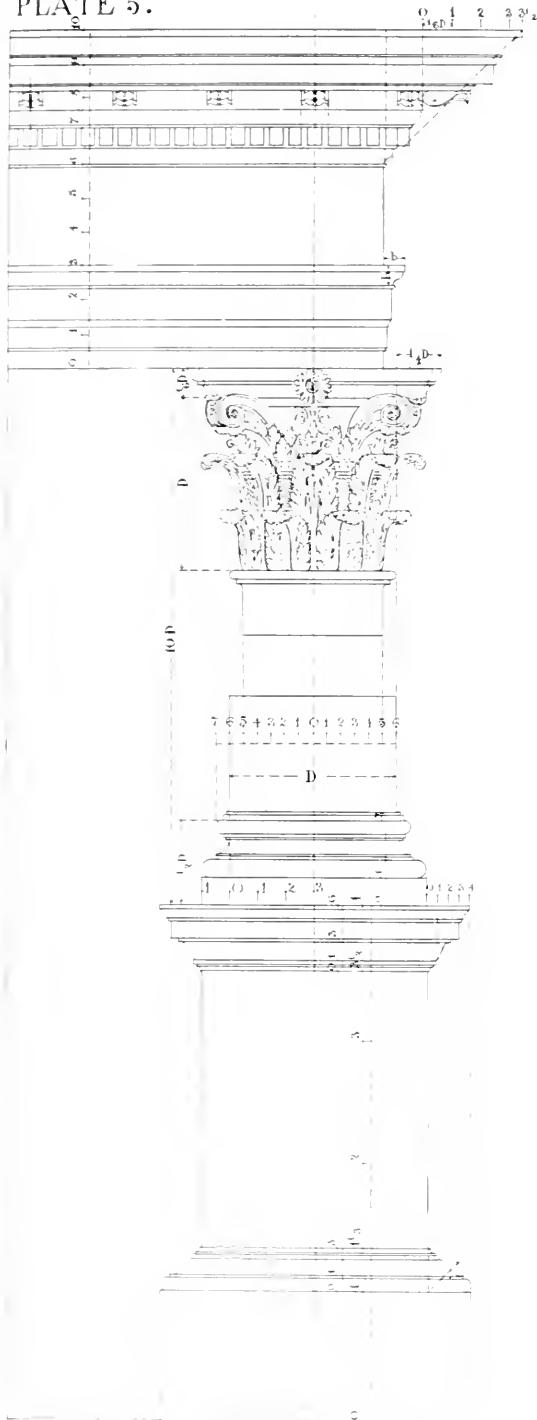


Plate V.

The Corinthian Order has been represented with considerable variations from the original type.

The Ionic entablature was often used by the ancients, supported by Corinthian columns, and the Corinthian cornice itself, though here represented with a dentil band, is often found without one. No general rule appears to exist for spacing the modillions or for their dimensions, the ratio of the width of the modillion to the space between two of them varying from $1:1\frac{1}{2}$ to $1:2\frac{1}{2}$, and again the number of the dentils between the modillions varies from 2 to 5 in different examples.

Both features should be symmetrically placed with reference to one another and to the centre line of the column, a point often neglected. To secure this result the following method is recommended:— Draw a modillion one-sixth of the diameter of the column in width, arranged symmetrically over the centre line of the column. Place another with its outside edge three and a half times its width within the total projection of the cornice, and thus obtain the spacing between the blocks. Divide the distance between two modillion centres into 15 parts, give two to a dentil, to be placed symmetrically under a modillion, and one to each space between the dentils, which will be found to bring the inside edge of the last dentil before the return, on the frieze line.

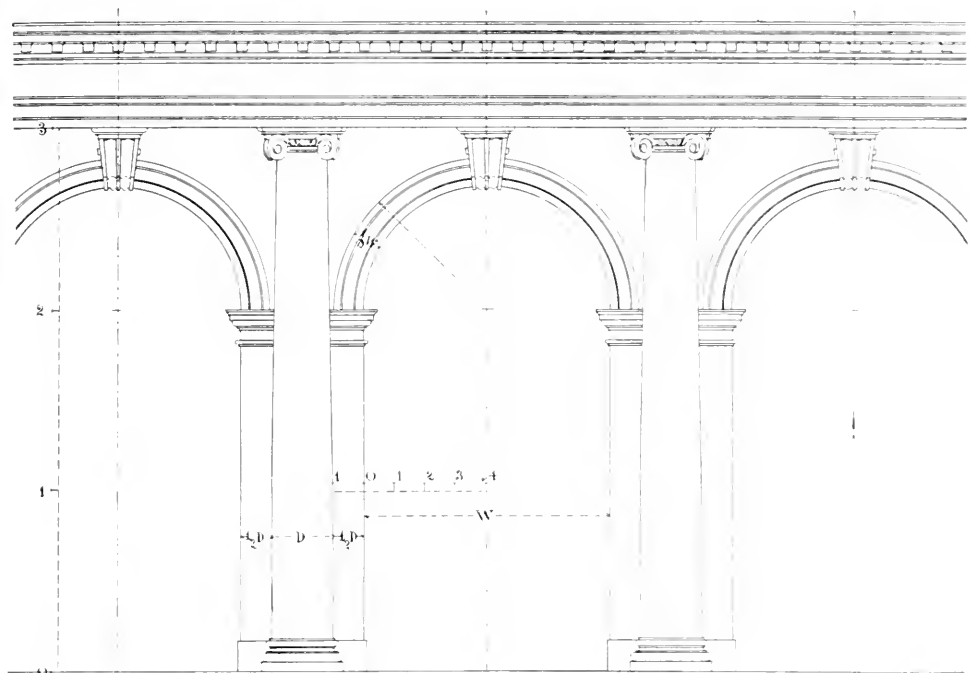
The form and projection of the leaves of the capital are largely matters of individual taste, but the general method of their arrangement will be evident after examining the drawing. It may, however, be noted that the eye of the volute is just outside the lower circumference of the shaft, and that the tiers of leaves divide the capital below the abacus into three approximate equal horizontal sections.

The column may or may not be fluted as in the Ionic Order.

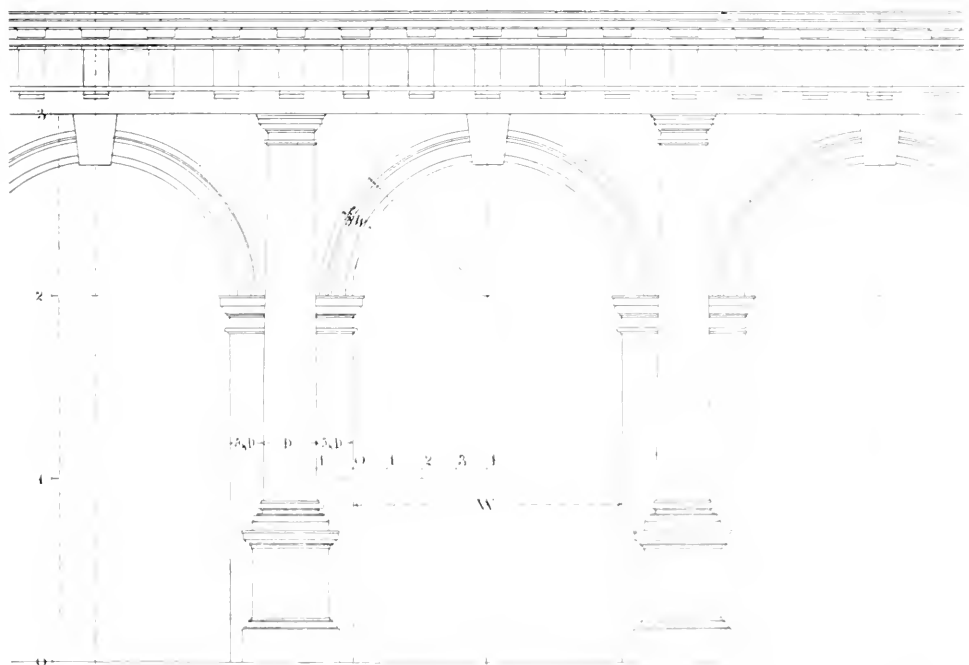
The attic base, as used in the Ionic Order, is very generally employed—in fact, it is often preferable to adopt it, omitting the additional mouldings shown, for the sake of variety, on the drawing.

CORINTHIAN

PLATE 6.



IONIC



DORIC

Plate VI.

The relations and dimensions given in this and similar subsequent plates must, therefore, be looked upon as necessarily somewhat elastic. At the same time, such dimensions as are given should not be disregarded, but considered in the light of proportions to be attained as far as the exigencies of the plan will admit.

The spacing of arcading dealt with in this plate should be governed by the height of the space to be treated, and it will be found that the best effects are obtained when the widths of the

seen that a relation exists between the diameter of the column, the width of the pilaster, and the width of the opening. Again, the diameter of the column relatively to the opening will be influenced by the presence, or absence, of a pedestal to the Order. The summary shown, collected from Gibbs's work, giving the dimensions to be aimed at in order to comply with the above relations, will be found useful.

The height of the impost should always be about two-thirds of the height from the ground to the soffit of the architrave of the Order, whether a pedestal is in use or not.

Diameter of Column = 1.

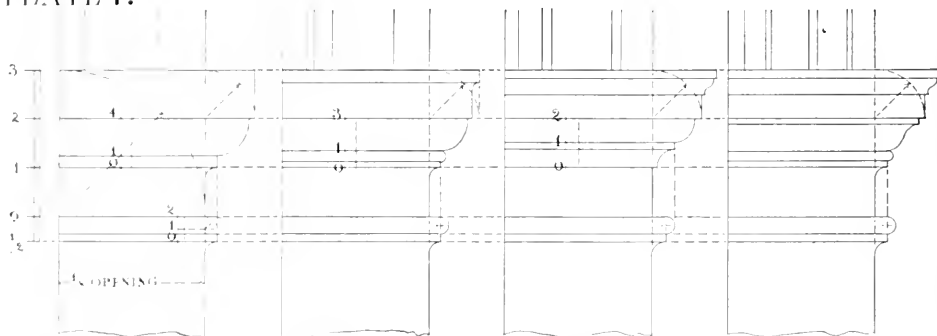
	Tuscan.		Doric.		Ionic.		Corinthian.	
	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.
Width of bay centre to center	6	7	6 1/4	7 1/2	6	7 1/2	6 5-12	8 1/8
Width of one pilaster	1/2	2/3	1/2	5/8	1/2	5/8	1/2	7-10
Width of opening	4	4 2/3	4 1/4	5 1/4	4	5 1/4	4 1/8	5 5/8

openings approximate to half of their height, and when the total width of the piers lies between one-half and two-thirds of that of the opening.

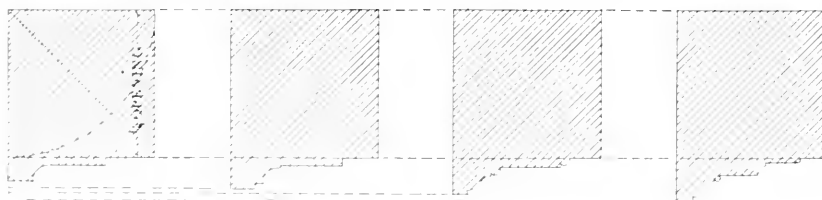
The spacing must also be considered in reference to the Order employed, so that when triglyphs, or modillions, are placed centrally over the columns their proper spacing may be interfered with as little as possible. It will thus be

The archivolt or moulding running round the arch should be the same width as the pilaster (less any necessary clearance for the mouldings)—that is, about one-eighth of the width of the opening, which should also be the height of the impost cap to the bottom of the necking. Further details as to the members will be found on Plate VII.

PLATE 7.



IMPOSTS AND ARCH MOULDINGS



TUSCAN

DORIC

IONIC

CORINTHIAN

Plate VII.
Impost Mouldings.

Details are here given of impost mouldings, with their archivolts, suitable for the different Orders. The divisions of the imposts are all simple and similar in each example, the height of the corona and of its mouldings above, if any, being equal to the height of the mouldings below, which, again, are equal to the necking. The bead and fillet below the necking are one-sixth of the height of the impost, the bead being double the height of the fillet. The projection of the impost beyond the line of the pilaster is equal to the height of the corona and member over in the

first two Orders, while the projection of the corona itself is equal to this height in the last two.

The pilaster is square on plan, and, therefore, the plan of the archivolt is represented by this square upon which the mouldings are placed. An examination of these mouldings will show that they resemble the architraves given for their respective Orders, and their forms admit of similar variations. It will be noticed that the innermost face is always in the plane of the face of the pilaster, while the projection of the moulding at the extrados increases from about one-quarter the width of the whole archivolt in the Tuscan to one-third in the Corinthian Order.

SUBJECT INDEX.

System of Classification for Filing Data, Drawings, Plates, Catalogues, Etc., in Architects' and Contractors' Offices.

INTRODUCTION.

The decimal system of classification was devised and elaborated by Mr. Melvil Dewey, formerly director of the New York State Library. This system was intended primarily for the use of librarians in the classification and arrangement of books and pamphlets, but it was soon found that the system furnished also a simple and effective means of classifying, indexing and filing literary matter of all kinds. Engineers have found it useful for indexing technical data and information, catalogs, reports, card systems, drawings, etc., and it has been found equally useful by manufacturing and business concerns.

Much of the following information is taken from the University of Illinois Engineering Experiment Station, Bulletin No. 9, prepared by L. P. Breckenridge, Professor of Mechanical Engineering, and G. A. Goodenough, Associate Professor of Mechanical Engineering, and Bulletin No. 13 by N. Clifford Ricker, D. Arch. Professor of Architecture.

EXPLANATION OF THE DECIMAL SYSTEM.

The essential characteristic of the Dewey System is its method of division and sub-division. The entire field of knowledge is divided into nine chief classes numbered by the digits from 1 to 9. Matter of too general a nature to be included in any of these classes is put into a tenth class and indicated by 0. The following are the primary classes of the Dewey System:

- 0 GENERAL WORKS
- 1 PHILOSOPHY
- 2 RELIGION
- 3 SOCIOLOGY
- 4 PHILOLOGY
- 5 NATURAL SCIENCE
- 6 USEFUL ARTS
- 7 FINE ARTS
- 8 LITERATURE
- 9 HISTORY

Each of these classes is again divided into nine divisions, with a tenth division for general matter, and each division is separated into nine sections. The sections are again sub-divided and the process may be carried as far as desired.

It is thought that this system will be especially valuable to architects for classifying drawings, catalogs, reports and technical data. Our space is too limited to publish the complete work, nor is it desirable. Should any one be sufficiently interested to go into the matter thoroughly, they should have Mr. Dewey's complete text on the subject. In order to make the application of the system clear in the briefest possible way, the miscellaneous information contained in this book has been assumed to comprise a small architect's library and has been classified according to the Dewey System. It is hoped that this will make clear the practical application to architects' libraries, both large and small. In succeeding years, we hope to be able to publish a more extensive relative index in which the items of the classification are arranged alphabetically, the one at present published only covering the items of miscellaneous information contained in this book, with some of the more important general topics. We are particularly concerned as practitioners of the profession of architecture with divisions 6 and 7, "Useful Arts" and "Fine Arts," comprising the following subject numbers:

- 600 USEFUL ARTS
- 610 MEDICINE
- 620 ENGINEERING
- 630 AGRICULTURE
- 640 DOMESTIC ECONOMY
- 650 COMMUNICATION AND COMMERCE.

- 660 CHEMICAL TECHNOLOGY
- 670 MANUFACTURES
- 680 MECHANIC TRADES
- 690 BUILDING

Omitting all sub-divisions of this topic, with the exception of 690 "Building," we publish the sub-divisions of same. As distinguished from "Architectural Construction," "Building" has to do more particularly with the processes of construction and matters pertaining to trades and materials involved in the construction of buildings should be more properly classified under "Building", while matters as to types and component architectural parts are more properly classified under Architectural Construction.

690 BUILDING — MATERIALS — TRADES.

See 721, for Architectural Construction, and 729, for Architectural Forms of Design.

GENERAL.

- .0 Biography of Builders.
- .01 Finance of Buildings.
- .02 Operation of Buildings.
- .1 THEORIES OF CONSTRUCTION.
- .11 Systems of Construction.
- .12 Engineering of Construction.
- .2 SUMMARIES OR COMPENDS.
- .21 Manuals; .22, Handbooks.
- .23 Receipts, Collections of.
- 690.3 ALPHABETICALLY ARRANGED KNOWLEDGE.
- .31 Cyclopedias; .32, Dictionaries.
- .4 DISSERTATIONS.
- .41 Lectures; .42, Discussions; .43, Essays.
- .5 PERIODICALS.
- .51 Daily; .52, Weekly; .53, Monthly; .54, Quarterly; .55, Annual.
- .6 SOCIETIES; PROCEEDINGS.
- .61 Trade Unions.
- .62 Exhibitions.
- .621 Materials; .622, Methods; .623, Construction.
- .63 Contractors' Associations.
- .631 Estimators' Clubs.
- .64 Engineering Societies.
- .65 Inspectors' Associations.
- .66 Material Dealers' Associations.
- .67 Manufacturers' Associations.
- 690.7 Education and Study.
- .71 Training of Workmen; .72, Apprenticeship; .73, Tools and Their Uses (see special trade for special tools); .74, Shop Practice; .75, Trade Schools; .76, Manual Training.
- 690.8 Museums.
- .81 Collections; .82, Patents; .83, Inventions; .84, Machines for Manufacturing; .841, Wood; .842, Stone; .843, Steel and Iron; .844, Bricks; .845, Tiles; .846, Cement and Lime; .847, Concrete; .848, Asphalt; .849.
- .9 History of Building Materials.
- .91 Ancient; .92, Mediaeval; .93, Renaissance; .94, Modern; .95, History of Building Construction; .951, Ancient; .952, Mediaeval; .953, Renaissance; .954, Modern.
- 691. Materials; Processes; Preservatives. See 620.1 for Strength of Materials. See 692, to 699, for Uses of Prepared Materials. If the user prefers, he may classify all his material on Building Engineering under 690.12.)
- .1 Woods.
- .11 Hard Conifers.
- .12 Soft Conifers.
- 691.13 Hard Leaf Woods.
- .14 Soft Leaf Woods.
- .15 Defects of Woods and Grading.
- .16 Injuries to Woods.
- .17 Preservation of Woods.
- .2 Stone; Material; Protection.

- .29 Preservation.
- .3 Stone, Artificial; Concrete.
- .31 Beton Coignet; .32, Ransome; .33, Hollow Block; .34, Selenitic; .35, Lime Concrete; .36, Cement Concrete; .39, Aggregate.
- .4 Ceramic Products.
- .41 Bricks.
- .42 Tiles.
- .432 Flooring.
- .441 Wall Tiles.
- .45 Hollow Structural Tiles.
- .451 Floor.
- .452 Roof and Ceiling Tiles.
- .453 Wall Tiles.
- .1 Wall Linings; .2, Bond Courses; .3, Partition.
- .46 Terra Cotta.
- .48 Sewer Tiles.
- .5 CEMENTING MATERIAL.
- .51 Lime.
- .52 Cement.
- .53 Asphaltum.
- .54 Glue.
- .55 Other Cementing Materials.
- .6 GLASS, SHEET, PLATE, CATHE-DRAL, OPALESCENT, PRISMATIC.
- .7 Iron; Steel; Anti-Rust Processes.
- .71 Cast Iron; .72, Malleable Cast Iron; .73, Wrought Iron; .74, Steel, Blister or Tool; .75, Steel, Crucible; .76, Steel, Bessemer; .77, Open Hearth; .79, Protection of Iron and Steel; .791, Painting; .792, Tinning; .793, Zincing (galvanizing); .794, Electroplating; .795, Bower-Barff Process; .796, Cement Coating; .797; .798; .799.
- .8 Other Metals.
- .81 Copper.
- .82 Nickel.
- .83 Zinc.
- .84 Lead.
- .85 Aluminum.
- .86 Tin; .861, Tin-coated Iron.
- .87 Silver.
- .88 Gold.
- .89 Metallic Alloys; .891, Bell-Metal; .892, Brass; .893, Bronze.
- .9 OTHER MATERIALS.
- .92 Fibriform; .921, Hair; .2, Jute; .3, Hemp; .4, Flax; .5, Wool.
- .93 Paper; .931, Sheathing; .2, Quilt; .3, Slating; .4, Roofing; .5, Wall Paper; .6, Board.
- .94 Fabrics, Woven; .941, Duck; .2, Burlap and Buckram; .3, Carpet; .4, Rugs; .5, Linings; .6, Shades; .7, Curtains and Hangings.
- .95 Asbestos, Serpentine; .951, Asbestos Cloth; .2, Plaster; .3, Moulded Sections; .4, Fiber, Loose; .5, Asbestos-Magnesia; .6, Asbestos Board; .7, Asbestos Shingles.
- .96 Bitumen; .961, Asphalt, Hard, Solid, Brittle; .2, Meltha or Mineral Tar; .3, Petroleum; .4, Naphthas.
- .965 Asphalt Products; .1, Paint; .2, Water-Proofing; .3, Cement; .4, Paving; .5, Roofing Cement.
- .966 Coal-Tar; .9661, Pitch; .2, Roofing Cement; .3, Mill-Board; .4, Felt.
- .967 Wood-Tar; .9671, Pitch; .2, Resin; .3, Varnish; .4, Cement.
- .97 Felt; .1, Roofing; .2, Deafening; .3, Insulating.
- .98 Compositions; .981, Cork Carpet; .2, Linoleum.
- 692 PLANS; SPECIFICATIONS; ESTIMATES.
- .1 General Drawings; .10, Drafting Room Supplies.
- .11 Plan, Location; .12, Plan, Foundation; .13, Plans, Floor; .14, Plan, Roof; .15, Elevations; .151, Front; .152, Side; .153, Rear; .154, Court; .155.
- .16 Sections; .161, Longitudinal; .162, Cross; .163, Special.

- .19 Other General Drawings.
- .2 DETAIL DRAWINGS.
- .21 Masonry.
- .22 Woodwork.
- .23 Metal Work.
- .24 SANITARY AND ILLUMINATING EQUIPMENT.
- .25 Heating and Ventilating.
- .26 Plastering.
- .27 Roofing Composition.
- .28 Glass Work.
- .29 Other Drawings.
- .3 SPECIFICATIONS.
- .30 Title Page, General Conditions, Etc.; .301, Excavation and Grading; —02, Mason Work, Fire Proofing and Structural Concrete (See 693.); —03, Cut Stone (See 693.); —04, Terra Cotta (See 693.); —05, Concrete, Walks and Floors (See 693.); —06, Structural Iron; —061, Ornamental Iron (See 694.); —07, Fire Escapes (See 694.927); —08, Carpenter Work and Rough Hardware (See 694.1 to 8); —09, Cabinet Work (See 694.7); —10, Sheet Metal Work, Slate and Tile Roofing (including metal frames, wire glass and skylights) (See 695.2); —11, Composition Roofing (See 695.6 to 8); —12, Drainage, Sewerage and Plumbing (See 696.1 to 6); —13, Gas Fitting (See 696.7); —14, Electric Wiring, Telephones, Bells, and Speaking Tubes (See 696.91 to 9); —15, Electric Power Machinery; —16, Power Equipment other than Electrical; —17, Heating and Ventilation (See 697.1 to 9); —18, Pipe Covering (See 697.46, also 691); —19, Plastering, 1 Plain and 2 Ornamental (See 698.9); —20, Glazing, 1 Sheet Glass, 2 Plain Glass, 3 Mirrors (See 698.5); —21, Art Glass (See 729.8, also 691.); —22, 1 Painting, 2 Varnishing, 3 Staining (See 698.); —23, Decoration of Walls, Painted and Hung (See 698.); —24, Tile, Mosaic and Marble (See 729.7); —25, Mantels and Consoles (See 729.95 and 694.7); —26, Finish Hardware (See 694.24); —27, Elevators, Dumb Waiters, Parcel Lifts and Conveyors; —28, Gas Range (See 696.63); —29, Refrigerating Equipment (See 696.62); —30, Shades, Curtains and Hangings for Openings (See 729.97); —31, Carpets, Rugs, Etc.; —32, Screens (See 721.875); —33, Lighting Fixtures (See 729.93); —34, Furniture, including Seating, Tables, Desks, Etc. (See 729.92); —35, Organs (See 729.98); —36, Landscape Gardening (See 710.).
- .4 Contracts. Agreements. Bids. Advertisements.
- .5 Estimates. Quantities. Cost.
- .51 By Cubical Contents.
- .52 By Square Foot Floor Area.
- .53 By Trades or Units, divided as 692.3.
- .6 Superintendence.
- .7 Supervision of Accounts.
- .8 Professional Services. Fees. Com-missions.
- .9 Building Laws. Liabilities of the Architect, Owner and Contractor.
- .91 State or General Laws.
- .92 City Ordinances.
- .93 Town or Village Ordinances.
- .94 Trade Rules.
- .95 Liabilities of Architects.
- .96 Liabilities of Owners.
- .97 Liabilities of Contractors.
- .98 Lien Laws.
- 693 MASONRY, PLASTERING, FIREPROOFING.
- .01 Mortar .02 Solids .03 Metal.
- .1 Stone Construction.
- .11 Bond Stone Work.

- 693
 .12 Cutting and Dressing of Stone (See 515.8, Stereotomy; 736, Stone Carving).
 .2 Brick Construction.
 .21 Bond of Brick Work.
 .22 Adobe or Sun Dried Brick.
 .3 Terra Cotta Construction.
 .4 Fire-proofing. Hollow Tile and Porous Terra Construction.
 .5 Concrete and Beton or Sub-marine Construction.
 .51 Massive.
 .52 Layers.
 .53 Hollow Blocks.
 .54 Sidewalks; 541, Methods; 542, Vault Covers and Doors; 543, Vault Lights.
 .55 Ornamental.
 .6 Reinforced Concrete.
 .61 Systems, arranged alphabetically.
 .62 Forms and Centers.
 .63 Testing and Inspection.
 .64 Data from Experiments.
 .65 Formulas.
 .66 Special applications.
 .7 Marble, Tile and Mosaic. Sanitary Composition.
 .71 Systems, arranged alphabetically.
 .8 Water-proofing.
 .81 Systems, arranged alphabetically.
 .9 Plastering.
 .91 External Plastering and Stucco.
 .92 Internal Plastering.
 .93 Ornamental Plastering.
 .94 Scagliola.
 .95 Wooden Lath. Furring and Grounds.
 .96 Metal Lath and Furring. Studs, Corners.
 .97 Mineral Wool Linings.
 .98 Plaster Board and Compo Board.
- 694 **FRAMED & BOXED CONSTRUCTION, CARPENTRY & METAL WORK.**
 .1 **WOOD CONSTRUCTION IN GENERAL, INC. PAPER BOARD.**
 .11 Ordinary.
 .111 Balloon Const. for Frame Buildings.
 .112 Joist Const. for Masonry Buildings.
 .12 Heavy Timber Construction.
 .121 Heavy Post and Timber Const. for Frame Buildings.
 .122 Mill Const. for Masonry Buildings.
 .13 Auxiliary Wood Const. for Fire-proof Buildings.
 .131 Centering, Forms, Protective Covering.
 .132 Grounds, Attachment Strips, etc.
 .2 **JOINTS OF WOOD-WORK, FRAMING, ATTACHMENTS.**
 .21 Wood-Pins; 2, Tenons; 3, Mortise; 4, Dove-tail; 5, Splice, etc.
 .22 Glue, Cement, etc.
 .23 Metal Formed Joints, Concealed Rough Hardware.
 .231 Nails, Spikes.
 .232 1, Bolts and Rods; 2, Rivets; 3, Washers, Flitch-plates; 4, Stirrups, Anchors, Hangers, Ties, Box and Wall Anchors and Plates, etc.; 5, Coal Chutes, Ash-receptors, Metal Chimney Caps.
 .233 1, Pivots; 2, Hinges; 3, Pulleys; 4, Cords and Chains; 5, Weights, etc.; 6, Door Hangers; 7, Turn Tables.
 .24 Exposed Metal-formed Joints and Protections, Finish Hardware.
 .241 Hinges, Butts, Hooks, Latches, Bolts, Locks, Escutcheons, Roses, Key-plates, Kick-plates, Pulls, Sockets, Lifts, etc.
 .242 Bumpers, Strikes, Angle Covers, Holders, etc. Weather Strips, Thresholds, Treads for Stairs.
 .243 Closing Mechanism Springs, Spring-checks, etc.
 .244 Step-ladders.
 .245 Carriers of Merchandise. Derricks and Hoists.
 .246
 .247
- 694.248 Show Cases.
 249
 .3 **STRENGTHENED BEAMS.**
 .4 **POSTS, COLUMNS (See 721.31).**
 .5 **PANELED AND LATTICED CONSTRUCTION, HALF TIMBER WORK.**
 6 **JOINERY, GENERAL MILL WORK.**
 1, Frames; 2, Sash; 3, Doors, Panel, Revolving and Rolling; 4, Blinds; 5, Screens; 6, Trim; 7, Flooring.
 .7 **ORNAMENTAL JOINERY, CABINET WORK.**
 1, Cabinets, Cases, etc. (See 729.9).
 .8 **STAIR BUILDING (See 515.83 Stereotomy).**
 .9 **METAL WORK.**
 .91 Structural.
 .911 Material (See 691.7).
 .912 Cast.
 .913 Wrought.
 .914 Rolled.
 .915 Connections.
 .916 Metal Lumber.
 .92 Ornamental.
 .921 Material (See 691).
 .922 Cast.
 .923 Wrought.
 .924 Drawn.
 .925 Guards and Grilles, Enclosures, Solid Metal Sash.
 .926 Stairs.
 .927 Fire-Escapes.
 .928 Vault Doors, Fire-Door and Shutters.
- 695 **SHEET, SHINGLE & COMPOSITION COVERING, OVERLAYING CONSTRUCTION.**
 .1 **WOOD SHINGLES (See 694.1).**
 .2 Sheet Metal and Allied Const.
 .21 Materials (See 691); .22, Specifications for (See 692.3-10); .23, Cost of (See 692.53-10).
 .24 Formed Sheet-metal.
 .241 Moulded Work, Spun and Hammered Ornaments, Ventilator Caps and Ducts.
 .242 Utensils, Cans, etc.
 .243 Sky-light bars.
 .244 Window Frames and Sash, Sheet Metal Doors, Hinged, Rolling and Sliding.
 .25 Glass for Sky-lights and Fire-proof Windows.
 .251 Shingles of Metal, Slate or Composition.
 .252 Kinds of, arranged alphabetically.
 .253 Tests, Sizes, Preservatives.
 .26 Tile of Metal, Slate, Terra Cotta or Composition.
 .261 Kinds of, arranged alphabetically.
 .27 Corrugated and Stamped Metal Roofing and Siding.
 .28
 .29
 .3 **STAMPED METAL WALL AND CEILING DECORATIONS.**
 .31 Kinds of, arranged alphabetically.
 .4 Sheet Metal Trim. and Furniture.
 .5
 .6 **COMPOSITION.**
 .61 1, Asphalt; 2, Tar; 3, Concrete, Melted.
 .62 1, Felt; 2, Asbestos; 3, Paper; 4, Mineral Wool; 5, Canvas.
 .7 **DEAFENING FELTS AND QUILTS.**
 .8 **TEXTILE DUCK, CANVAS, BURLAP.**
 9. **THATCH AND OTHER COVERINGS.**
- 696 **SANITARY EQUIPMENT, ILLUMINATION (Drainage, Sewerage, Plumbing, Gas-Fitting, Electric Lighting).**
 .1 **DRAINAGE.**
 .2 **SEWERAGE.**
 .21 Sewer Pipe.
 .22 Catch Basins.

- 696.23 Garbage Disposal.
 .24 Soil and Waste Pipe.
 .3 **PLUMBING.**
 .4 **WATER SUPPLY.**
 .41 Cold Water.
 .411 Pumps.
 .413 Tanks; 4, Hose; 5, Fire Protection;
 6, Filters; 7, Sterilizers; 8, Ice
 Machinery; 9, Stills, etc.
 .42 Hot Water.
 .421 Boilers, Tanks.
 .422 Heaters, Coal, Gas, Garbage Burners.
 .5 **JOINTS. ANCHORS. SUPPORTS.**
PIPE.
 .6 **FIXTURES FOR PLUMBING.**
 .61 Water Closets, Lavatories, Sinks,
 Wash-trays, Baths, etc.
 .62 Refrigerators, Water Coolers.
 .63 Gas Ranges, Clothes Dryers, Laun-
 dry Machinery.
 .64 Brass Goods.
 .7 **GAS FITTING** (for fixtures, see
 729.99).
 .8 **OTHER BRANCHES. PNEUMATIC**
CLEANING. GASOLINE STOR-
AGE TANKS.
 .9 **ELECTRIC EQUIPMENT FOR IL-**
LUMINATION, COMMUNICATION
AND POWER PROTECTION.
 .91 Kinds of Conduit, arranged alpha-
 betically.
 .92 Wire; 1, Gauges; 2, Kinds.
 .93 Insulation.
 .94 Switch-boards; 2, Switches; 3, Cut-
 outs; 4, Transformers; 5, Sockets,
 Receptacles, Rosettes.
 .95 1, Bells; 2, Speaking Tubes; 3, Tele-
 phones; 4, Batteries; 5, Letter Boxes.
 .96 1, Burglar Alarms; 2, Door Openers;
 3, Lightning Rods; 4, Other
 Branches.
 .97 Fixtures (See 729.99).
 .98 Power Machinery.
 .99 **Laws. Company Restrictions, etc.**
 697 **HEATING, VENTILATION AND**
STEAM POWER.
 .1 **FIRE PLACES.** Dampers and Ash
 Drops, Trimmings.
 .2 **STOVES.**
 .3 **FURNACES.**
 .4 **HOT WATER AND STEAM.**
 .41 Hot Water; 1, Low Pressure; 2, High.
 .42 Steam; 1, Low Pressure; 2, High; 3,
 Vacuum.
 .43 Boilers; 1, Steel Water Tube; 2,
 Steel Flue Tube; 3, Cast-iron Sec-
 tional; 4, Grates; 5, Setting.
 .44 1, Valves; 2, Pipes; 3, Regulators;
 4, Trimmings for Boilers; 5, Ther-
 mometers; 6, Sprinkler Fittings.
 .45 Radiation, arranged alphabetically.
 .46 Pipe Covering.
 .47 Oil Engines.
 .5 Feed Water Heaters, etc.
 .5 **ELECTRIC AND OTHER**
METHODS.
 .6 **LAUNDRY MACHINERY.**
CLOTHES DRYERS.
 .7 **FUELS.** Fuel Handling Machinery.
 .8 **SMOKE FLUES. SMOKE PREVEN-**
TION.
 .9 **VENTILATION.** 1, Air Ducts; 2,
 Conduits; 3, Registers; 4, Fans.
 698 **PROTECTIVE, PRESERVA-**
TIVE AND DECORATIVE
COVERING. (Painting, Wall-
 Hanging, Glazing, Floor Cover-
 ing).
 .1 Painting; .11, Oil; .12, Cold-water;
 .13, Stains Ext.; .14, Enamel Ext.
 .2 Distemper and Fresco.
 .3 1, Varnishing; 2, Polishing Wax; 3,
 Staining; 4, Enamel.
 .4 Other Modes of Protection.
 .5 **Glazing.** See 748, Stained Glass.
 .1, Stained Glass; .2, Plate Glass;
 .3, Ornamental Glass; 4, Prisms; .5,
 Mirrors; 6, Putty and Elastic Cem-
 ent.
 .6 Paper-hanging.
 .7 Textile Hangings. Tapestry.
 .8 Relief Work. Lincrusta. Stamped
 Leather, etc.
 .9 Other branches. Carpets, Awnings,
 Curtains and Rugs.
 699 and Rugs, Rubber Matting and Tile.
 700 **CAR AND SHIP BUILDING.**
 701 **FINE ARTS.**
PHILOSOPHY. THEORIES.
UTILITY. AESTHETICS.
COMPENDS. OUTLINES.
 702 **DICTIONARIES. CYCLOPEDIAS.**
 703 **ESSAYS. LECTURES. ADDRESSES.**
 704 **PERIODICALS. MAGAZINES. RE-**
 705 **VIEWS.**
 706 **SOCIETIES. TRANSACTIONS. RE-**
 707 **PORTS, ETC.**
EDUCATION. STUDY AND TEACH-
ING OF ART.
 708 **ART GALLERIES AND MUSEUMS.**
 709 **HISTORY OF ART IN GENERAL.**
 Divided like 930-999.
 710 **LANDSCAPE GARDENING.**
 711 **PUBLIC PARKS.**
 712 **PRIVATE GROUNDS. LAWNS.**
 713 **WALKS. DRIVES. BRIDGES.**
 714 **WATER. FOUNTAINS. LAKES.**
 715 **TREES. HEDGES. SHRUBS.**
 See also 634.9, Forestry; 582, Bot-
 any.
 716 **PLANTS. FLOWERS.**
 .1, Plants; .2, Flowers; .3, Conserva-
 tories; .4, Window gardens; .5, Fern-
 eries.
 717 **ARBORS. SEATS. OUTLOOKS.**
 718 **MONUMENTS. MAUSOLEUMS.**
 719 **CEMETERIES.** See also 393.1, Earth
 burial; 614.61, Public health.
 720 **ARCHITECTURE.**
 .1 Theories, Esthetics, Architectonics;
 .2, Compends, Manuals; .3, Diction-
 aries, Cyclopedias; .4, Essays, Lec-
 tures; .5, Periodicals; .6, Societies;
 .7, Education, Study, Training,
 Schools of Architecture; .8, Poly-
 graphy, Collections; .9, General His-
 tory of Architecture, divided geogra-
 phically like 940-999.
 721 **ARCHITECTURAL CONSTRU-**
CTION.
 .1 Foundations. See Bridge Engineer-
 ing, 624.1, Foundations.
 .2 Walls, Partitions, etc.
 .3 Piers, Columns.
 .4 Arched Constructions.
 721.5 Roofs. See 695, Roof Coverings;
 .6 Floors and Flooring. See 620.8.
 .7 Ceilings.
 .8 Doors, Windows.
 .9 Iron and Composite Structures.
 722 **ANCIENT ARCHITECTURE.**
 Include under this general classifica-
 tion all architecture from the be-
 ginning up to about A. D. 200 to
 300.
 .00 Prehistoric Architecture.
 .1 Egyptian or Nile Valley. (Period
 4000 B. C. to about 527 B. C.)
 .11 Old and Middle Empire. (4000-
 2000.)
 .12 Shephard Kings (2000-1600 ?).
 .13 Thebian New Empire (1600-1250).
 .14
 .2 Mesopotamian Architecture. Period
 3000 ? to about 536 B. C.
 .21 Chaldaean (3800 ? to 1500 ? B. C.).
 .22 Assyrian (1500 ? to 1020 ? B. C.).
 .23 Babylonian (1620 ? to 536 B. C.).
 .24 Persian-Median (536 B. C. to 293
 A. D.).
 .241 First Empire founded by Cyrus
 (536-334).
 .242 Sasanian Period (334 B. C. to A. D.
 224).
 .3 East Asian Architecture. Little is
 known of Chinese, Korean, Japan-
 ese, Indian and Philippine Archi-
 tecture of the ancient period and
 dates can hardly be approximated.

- .4 Pelasgic Architecture.** North and east Mediterranean, including the islands of that sea.
- .41 Aegian.** .42, Pre-Mycæan. .43 Mycæan. .44, Post-Mycæan. .45 Homeric and .46 Early Hittite.
- .5 Grecian or Hellenic Period** (1500 ? to 100 B. C.).
- .51 Heroic Period** (1500 ? to 776).
- .52 Hellenic proper** (776 ? to 100). .521 Doric, no other to 430 B. C.; .522, Ionic (430 to 330 ? B. C.); .523, Corinthian; only a few examples.
- .6 Roman,** Period 753 ? B. C. to 323 A. D.
- .61 Regal** (753 ? B. C. to 510 ? B. C.).
- .62 Republic** (510 ? B. C. to 27 B. C.).
- .63 Imperial** (27 B. C. to 323 A. D.). .631, Tuscan. .632, Doric; .633, Ionic; .634, Corinthian; .635, Composite.
- 723 MEDIAEVAL ARCHITECTURE.** The Architecture of the Middle Ages is generally understood to extend over a period from 300 A. D. to about 1450 A. D.
- .1 Byzantine or Early-Christian.** Developed under the Roman Emperor Constantine, at Constantinople, and to a more or less extent in all countries bordering the Mediterranean.
- .11 Basilican Type,** derived from the Roman business exchange, adopted more generally as the early Christian church in Western and Northern Europe.
- .12 Baptistry Type,** derived from the Roman Bath, adopted more generally in Eastern Europe and Western Asia and North Africa for early Christian Church, motif for Mohammedan Mosque. .121, Early Christian subdivided according to political divisions of the time. .122, Mohammedan-Moorish effected with Persian influence later becomes a distinct style.
- .2 PERSIAN MEDIAEVAL** (293 A. D. to 1499). Developed under more or less Roman influence up to Mohammedan conquest; after that gradually developed the Mohammedan Style.
- .21 Sasanian** (293 A. D. to 652 A. D.).
- .22 Mohammedan** (652 to 1499 A. D.).
- .3 Indian.**
- .31 Buddhist.**
- .32 Jaina.**
- .33 Brahman.**
- .34 Indo-Moslem.**
- .4 Chinese, Korean and Japanese.**
- .5 Mohammedan Style.**
- .51 Moorish, Turkish, Persian, Indian.**
- .6 Romanesque.** The Architecture of Europe between the Roman-Byzantine period and the Gothic (Period about 900 A. D. to about 1100 A. D.). .61, Austrian; .62, British Isles; .63, French and Belgian; .64, German; .65, Holland and Switzerland; .66, Italian; .67, Scandinavian; .68, Spanish; .69, Unclassified.
- .7 Gothic.** The Architecture of Europe between the Romanesque period and the Neo-Classic (Period about 1150 A. D. to 1450 A. D., traces in Spain and Italy as far back as 475 A. D.). The name means Architecture of the Goths.
- .71 Austrian;** .72, British Isles; .63, French and Belgian; .64, German; .65, Holland and Switzerland; .66, Italian; .67, Scandinavian; .68, Spanish and Portuguese; .69, Unclassified.
- 724. MODERN.**
- .1 Renaissance;**
- .2 Classical Revival. Grecian.**
- .3 Gothic Revival.**
- .4 Tudor Gothic Revival.**
- .5 Queen Anne Revival.**
- 724.6 Neo Grec.**
- 725.7 Half-Timber Swiss.**
- .8 Romanesque Revival.**
- .9 Other Recent Styles.**
- 725 PUBLIC BUILDINGS.**
- .1 Administrative. Governmental.** Capitols. Houses of Parliament. Ministries of War, State, etc. City and Town Halls. Bureaus. Public Offices. City Plans.
- .14 Custom Houses. Bonded Warehouses. Excise Offices.**
- .15 Court Houses. Record Offices.**
- .16 Post Offices, General and Special.**
- .17 Official Residences. Palaces of Rulers.**
- .18 Barracks. Armories. Police Stations.**
- .19 Engine Houses. Fire Alarm Stations.**
- .2 Business and Commercial.**
- .21 Stores, Wholesale and Retail.**
- .22 Mixed Store, Office, and Apartment Buildings.**
- .23 Office Buildings. Telegraph. Insurance. Loft.**
- .24 Banks. Safe Deposit. Savings.**
- .25 Exchanges. Boards of Trade.**
- .26 Markets.**
- .27 Cattle Markets. Stock Yards.**
- .28 Abattoirs.**
- .29 Other Business Buildings.**
- .3 Transportation and Storage.**
- .31 Railway Passenger Stations.**
- .32 Railway Freight Houses.**
- .33 Railway Shops, Round Houses, Car Houses, Tanks, Stores.**
- .34 Dock Buildings. Wharf Boats and Houses.**
- .35 1, Warehouses; 2, Cold Storage; 3, Safe Deposit Storage.**
- .36 Elevators, Grain.**
- .37**
- .38**
- .39 Other.**
- .4 Manufactories.**
- .41 Textile Factories or Mills. Wool, Cotton, Silk.**
- .42 Breweries. Malteries. Distilleries.**
- .43 Foundries. Machine Shops. Iron and Steel Works.**
- .44 Wood-working Mills. Furniture Factories.**
- .45 Carriage and Car Factories.**
- .46 Paper Mills.**
- .47 Mills for Flour, Meal, Feed, etc.**
- .48 Pottery, Glass, Terra Cotta, Brick Works.**
- .49 Other Manufactories.**
- 725.5 Hospitals and Asylums.** See also 725.6. Reformatories.
- .51 Sick and Wounded. Eye and Ear. Incurables. Lying-in.**
- .52 Insane.**
- .53 Idiotic. Feeble-minded.**
- .54 Blind. Deaf and Dumb.**
- .55 Paupers. Almshouses.**
- .56 Aged.**
- .57 Children. Orphans.**
- .58 Foundling.**
- .59 Soldiers' Homes.**
- .6 Prisons and Reformatories.**
- .61 State Prisons. Penitentiaries.**
- .62 Jails. Cell Houses.**
- .63 Reformatories for Adults. Houses of Correction.**
- .64 Reform Schools.**
- .65 Inebriate Asylums.**
- .7 Refreshment. Baths. Parks.**
- .71 Cafés. Restaurants.**
- .72 Saloons.**
- .73 Baths: Warm, Medicated, Turkish, Russian.**
- .74 Swimming Baths.**
- .75 Buildings for Watering Places, Spas, etc.**
- .76 Buildings for Parks and Streets. Public Comfort Stations.**
- .8 Recreation.**
- .81 Music Halls. Auditoriums.**
- .82 Theatres. Opera Houses.**

- 725 Halls for Lectures, Readings, etc.
 .83 Bowling Alleys, Billiard Saloons.
 .84 Gymnasiums, Turn Halls.
 .85 Skating Rinks, Bicycle Rinks.
 .86 Boat Houses, Bath Houses.
 .87 Riding Halls and Schools.
 .88 Shooting Galleries.
 .89 Other Public Buildings.
 .90 Exhibition Halls.
 .91 Temporary Halls, Tabernacles, Wigwams.
 .92 Workingmen's Clubs and Institutes.
 .93 Town Squares.
 .94 Summer Recuperating Camps.
 726 **ECCLIASTICAL AND RELIGIOUS.**
 .1 Temples.
 .2 Mosques.
 .3 Synagogues.
 .4 Chapels, Sunday-school Buildings.
 .5 Churches.
 .51 Frame.
 .52 Brick or Stone.
 .521 Small Audit., seating less than 600.
 .522 Large Audit., seating more than 600.
 .6 Cathedrals.
 .7 Monasteries, Convents, Abbeys.
 .8 Mortuary, Cemetery Chapels, Receiving Vaults, Tombs.
 .9 Other. Y. M. C. A., etc.
 727 **EDUCATIONAL AND SCIENTIFIC.**
 .1 Schools.
 .11 Ward and Grammar.
 .12 High Schools.
 Study and Recitation Rooms. Not including dormitory or boarding.
 .2 Academies, Seminaries, Boarding Schools.
 .3 Colleges, Universities.
 .4 Professional and Technical Schools. Law, Theology, etc.
 .5 Laboratories; Physical, Chemical. See 542.1, Biological, etc. Zoological and Botanic Gardens. See also 590.7 and 590.7.
 .6 .1, Museums. .2, Herbariums. See 580.7.
 .7 .1, Art Galleries. .2, Studios.
 .8 Libraries. See 022, Library Buildings.
 .9 Other. Learned Societies, etc.
 728 **RESIDENCES.**
 .1 Tenement Houses.
 .11 City Homes of Poor.
 .12 Country Homes of Poor.
 .13 Cities Ouvrieres.
 .2 Collective Dwellings.
 .21 Flats; one family to the floor.
 .211 Small Flats less than 8 rooms.
 .212 Large Flats, 8 rooms or more.
 .22 Apartment Houses; more than one family to floor.
 .221 Five Suites or Less.
 .222 Six Suites or More.
 .2221 Elevator Service.
 .2222 No Elevator Service.
 .3 City Houses, Mansions, Palaces.
 .31 Between party-walls, Stone.
 .32 Between party-walls, Brick.
 .33 Between party-walls, Partly wood.
 .34 Semi-detached, including end houses in city blocks, Stone.
 .35 Semi-detached, including end houses in city blocks, Brick.
 .36 Semi-detached, including end houses in city blocks, Partly wood.
 .37 Detached, Stone.
 .38 Detached, Brick.
 .39 Detached, Partly wood.
 .4 Club Houses, Buildings for Secret Societies.
 .5 Hotels.
 .51 City Hotels.
 .52 Summer Resorts.
 .53 Country Inns.
 .6 Village and Country Homes.
 .61 Village Dwellings. On small lots.
 .62 Stone.
 .63 Brick.
 .64 Concrete or stucco.
 728.65 Part masonry, part wood.
 .66 All wood, 1, less than 7 rooms, 2, 7-12 rm; 3, 13 rm or over.
 .67 Farm Houses.
 .68 Laborers' Cottages. 1, Frame; 2, Masonry.
 .7 Seaside and Mountain Cottages. Chalets.
 .8 Country Seats.
 .81 Castles.
 .82 Chateaux.
 .83 Manor Houses.
 .84 Villas.
 .85 Log Houses.
 .86 Bungalows.
 728.9 **Out-Buildings.**
 .91 Porters' Lodges.
 .92 Servants' Quarters.
 .93 Kitchens and Laundries.
 .94 .1, Stables. .2, Carriage Houses. .3, Garages.
 .95 Barns, Granaries.
 .96 Dairies.
 .97 Ice Houses.
 .98 Conservatories, Green Houses, Graperies.
 .99 Other.
 729 **ARCHITECTURAL DESIGN AND DECORATION.**
 .1 The Elevation.
 .11 Composition; .12, Distribution; .13, Proportion; .14, Light and Shade; .15, Perspective effect; .16, .17, .18, .19.
 For projection of shadows and graphics of light and shadow see 515.63 and 515.7.
 .2 The Plan.
 .21 Elements required; .22, Distribution; .23, Proportion; .24, .25, .26, .27, .28, .29.
 .3 Elementary Forms. For construction of these forms see 721.
 .31 Walls, Mouldings, Cornices. .32, Piers, Columns, Pilasters, Pedestals and the Orders, Colonnades. .33, Arches and Arcades. .34, Vaults and Domes. .35, Roof, Spires, Dormers. .36, Towers. .37, Gables and Pediments. .38, Doors and Windows. Bays, Orfels. .39, Stairs and Balustrades. See also 515.83, Stereotomy; 604.8, Building.
 .4 Painted Decoration.
 729.5 **Decoration in Relief.**
 .6 Incrustation and Veneering.
 .7 Mosaic and Marble.
 .71 Mosaic Ceilings; .72, Mosaic Walls; .73, Mosaic Floors; .74, Other Mosaic designs; .75, .76, .77, .78, .79.
 .8 Stained Glass Design. For technical processes see 666.1; for history see 748.
 .9 Architectural Accessories and Fixed Furniture.
 .91 Altars, Pulpits, Tribunes, Dais Thrones (Eccllesiastical).
 729.92 Seating for Public Buildings.
 .921 Benches; 2, Settees; 3, Portable Chairs and Opera Chairs.
 .93 Domestic Chairs, Tables, Couches, Stools, Beds, etc.
 .94 Buffets.
 .95 Mantels, Overmantels, Andirons.
 .96 Steel Furniture.
 .97 Window Shades.
 .98 .1, Organs. .2, Pianos.
 .99 Lighting Fixtures.
 730 **SCULPTURE.**
 731 **MATERIALS AND METHODS.**
 732 **ANCIENT.**
 733 **GREEK AND ROMAN.**
 734 **MEDIEVAL.**
 735 **MODERN.**
 736 **CARVING. SEALS. DIES. GEMS. CAMEOS.**
 737 **NUMISMATICS. COINS. MEDALS.**
 738 **POTTERY. PORCELAIN.**
 739 **BRONZES. BRASSES. BRIC-A-BRAC.**

INDEX TO MISCELLANEOUS AND USEFUL INFORMATION

According to Decimal System with Page Numbers and Relative Index

- Acoustics, Architectural. p. 339.
American Expression in Architecture. Vol. XIII, 263.
 Ancient and Primitive Architecture. F. 722
 Apartment Houses. Flats. Family Hotels. F. 728.2.
 Arch., To Find Radius of. F. 692.1, p. 275, Vol. XII.
 Arched Construction. F. 721.4.
 Architect, His Duties and Responsibilities, p. 247, Vol. XVI.
 Architecture. F. 720.
 Architecture Orders of. p. 391-400.
 Architecture, American Expression of. Vol. XIII, 263.
 Architectural Accessories and Fixed Furniture. F. 729.9.
 Architectural Construction. F. 721.
 Architectural Design and Decoration. F. 729.
 Arithmetical Tables. F. 690.12, p. 368.
 Automobiles, space occupied by. p. 377.
Barrels and Boxes, Dimensions of. F. p. 280.
 Bars Concrete reinforcement specifications for. p. 265.
 Base Plates for Columns. F. 690.12, p. 219, Vol. XIII.
 Bay Windows. 692.1, p. 379.
 Beams, Small T. Functions of. p. 239, Vol. XV.
 Beams, Wooden—Formula F. 690, p. 355.
 Beams, Yellow Pine, Table of, Strength of. p. 356-357.
 Bearing Plates for Columns and Beams. p. 219, Vol. XIII.
 Billiard Rooms. Sizes for. F. 692, p. 380.
 Board Measure. F. 694.0, p. 385.
 Boiler Efficiency, p. 389.
 Boilers, Steam and Hot Water. F. 697.43, p. 389.
 Bond Used in Brickwork. p. 373.
 Borings—Hardpan. p. 269.
 Bowling Alley. Sizes for. F. 377, p. 301.
 Breweries—Data. F. 692, p. 282, Vol. XIII.
 Brick Construction. F. 693.2, p. 381.
 Brick, Old, Meas. of. F. 693.2, p. 381.
 Brickwork, Wt. of. F. 693.2, p. 381.
 Building. F. 690.
 Brick Old, Meas. of. F. 693.2, p. 381.
 Buildings with sidings, data on. p. 377.
Carpentry, Joinery, Mill-work, Cabinet-work, Stair-building. F. 694, p. 382.
 Catalogues, System of Filing. p. 401.
 Classification for Filing Data, Drawings, Plates, Catalogues, etc. p. 401.
 Coal, Space Required in Bins. p. 389.
 Code of Professional Ethics. p. 25.
 Concrete, Economics of. 213, Vol. XIII.
 Conveying Machinery in City Buildings. 247, Vol. XIII.
 Conveying Machinery, by S. F. Joor. p. 243, Vol. XV.
 Ceilings. F. 721.7.
 Cement, Standard Specifications for. p. 199, Vol. XV.
 Cementing Materials. F. 691.5, p. 278, Vol. XIII.
 Cement, Treatment and Finish of. p. 231, Vol. XVI.
 Ceramic Products. 691.4.
 Circle, Mensuration of. F. 692, p. 366.
 Cisterns—Capacities. F. 696.413, p. 387.
 Clay Products, Burned. F. 691.4.
 Columns, Cast Iron—Safe Loads. F. 690.12, see 694.912, p. 261, Vol. XII.
 Composition. F. 695.6.
 Concrete floors, specifications for—p. 217.
 Concrete in Pounds Per Sq. Inch, Ultimate and Safe Strength of. 359.
 Concrete Work. Rules of Measurement. 211.
 Contracts, Agreements. Bids. Advertisements. F. 692.4.
 Conveying Machinery in City Buildings. p. 247, Vol. XIII.
 Conveying of Materials, Continuous. p. 213, Vol. XIV.
 Covering, Overlaying (Roofing). F. 695.
 Crosses and Symbols. F. 726, p. 299, Vol. XIII.
 Crushed Stone, Voids in. Vol. XI, p. 259.
 Design for Hooped Columns. p. 362-363-366.
Deafening Felts and Quilts. F. 695.7.
 Doors, Grates, Grilles, Windows. F. 721.8, see 694.63.
 Drainage. F. 696.1.
 Drain Pipes—Capacities. F. see 696.1, p. 388.
 Drains and Wells, Brickwork in. F. see 696.22, also 696.413, p. 388.
 Drawings, General, Helps in Preparing F. 692.01, p. 370-371-372.
Editorial, p. 21.
 Electric Equipment for Illumination and Communication. F. 696.9.
 Ellipse and Parabola. p. 378.
 Engineering. F. 620.
 Estimate—Data. p. 294, Vol. XVII.
 Estimates on Carpentry. See F. 694, p. 382.
 Estimates on Painting. F. 698, p. 325-329.
 Estimates Quantities, Cost. F. 692.5.
 Excavation, Rules for Measurement of. 241.
 Exposed Metal-formed Joints and Protections, Finish Hardware. F. 694.24.
Filing Catalogues, and Drawings, and Plates. 402.
 Finishing, of Wood. p. 255, Vol. XIII.
 Fire-proofing. F. 693.7.
 Flat Slab Construction. p. 233.
 Flooring Material, of Wood. 694.67.
 Floor Loading. p. 269, Vol. XIII.
 Floors and Flooring. F. 721.6.
 Foundations. F. 721.1.
 Foundations of Buildings. p. 142, Vol. I.
 Freight Cars, Sizes of. p. 380.
 Fuel, Space Occupied by. p. 389.
 Furnaces. F. 697.3.
 Foundations Datum. p. 257.
 Furniture Dimensions of. p. 377.
Gas Fitting. F. 696.7.
 Gauges and Their Equivalents. p. 282, Vol. XVI.
 General Works. F.
 Glass. F. 691.6, p. 277, Vol. XIII.
 Glass, Light Passing Through. F. 691.6, p. 277, Vol. XIII.
 Glass—Surface Heated by Radiation. F. 697, p. 390.
 Glass and Glazing. p. 333.
 Glazing. F. 698.5.
 Grades, Per Mile, Water Mains—Table of. F. 696.1 and 2, p. 387.
 Gravel Roofing, Specifications for. p. 301.
 Gravel, Use in Concrete. 213, Vol. XIII.
Heating and Ventilating. F. 697, p. 279, also p. 389.
 Hardpan Datum. p. 269.
 Heat, Transmission of. F. 697, p. 390.
 Hollow Tile and Porous Terra Cotta Construction. F. 693.4.
 Hooping for Core, Diameters and Hooping for Reinforced Concrete Columns. p. 362-363.
 Hospitals and Asylums. F. 725.5.
 Hotels. F. 728.5.
 Hot Water Heating. F. 697.41, p. 380.
 Hints and Formulae. pp. 279-293.
Impurities in Water. F. see 696.4, p. 387.
 Iron and Composite Structures. F. 721.5.
Joinery, General Mill-Work. F. 694.6.
 Joists—Carrying Capacity. F. 690.12, p. 260, Vol. XII.
Landscape Gardening. F. 710.
 Law, Data for Architects. p. 255, Vol. XIV.
 Law for the Licensing of Architects. p. F. 692.95, p. 139, Vol. III, p. 145, Vol. V.
 Laws Pertaining to Building. F. 692.9.
 Lead—Sheet. F. see 691.84, p. 287, Vol. XIII.
 Legal Standing of an Architect. p. 213, Vol. VII.
 Lien Law. p. 139, Vol. VI.
 Light, Transmission of. 277, Vol. XIII.
 Lighting Indirect. p. 209, Vol. XVI.
 Lighting for Billiard Rooms. p. 380.
 Lighting Protection. p. 255, Vol. XVII.
 Lighting Fixtures. F. 729.99.
 Limes—Cements—Plasters. F. 691.5, p. 278, Vol. XIII.
 Liquids, Hydrostatics, Hydraulics. F. 532.
 Lumber specifications 349.
Manufactories. F. 725.4.

Masonry in Pounds Per Sq. Inch, Ultimate and Safe Strength of. 360.

Materials, Building. F. 691, p. 283, Vol. XVII.

Materials in Construction. Weights of. p. 368-369.

Materials, Strength of. p. 267.

Materials, Wts. of. F. 691, p. 366.

Measures, Tables of. p. 366.

Measurement of Brick. p. 381.

Measurement of Carpentry Work. p. 382.

Measurement of Concrete. p. 241.

Measurement of Painting. p. 325.

Measurement of Plastering. Rules for. p. 313.

Measurement Formulae. p. 355.

Metal Formed Joints, Concealed Rough Hardware. F. 694.23.

Metal Lath and Furring. F. 693.96.

Metals, Except Iron and Steel. F. 691.8, p. 277, Vol. XIII.

Metals—Phys. Properties. F. 669, p. 283, Vol. XVII.

Metallurgy and Assaying. F. 699, p. 283, Vol. XVII.

Mill-work. 694.6.

Mortars. p. 381.

Mosaic and Marble. F. 729.7.

Nails for Different Work. F. 691.231, p. 385.

Natural Science. F. 500.

Nomenclature of Drawings. F. 692.1, p. 370.

Office Hours and Holidays. p. 199, Vol. VII.

Office Practice for Draughtsman. p. 73.

Orders of Architecture. File 729.3, p. 392.

Organs, Pianos. F. 729.98, p. 377.

Paint and Painting. F. 698, p. 325.

Painted Decoration. F. 729.4.

Painting Time an Important Factor. p. 255, Vol. XII.

Painting Structural Work. p. 259, Vol. XIII.

Paints, Table for Mixing. F. 698, p. 325.

Paints, Wall, Sanitary, Value of. p. 233, Vol. XIV.

Pianos. Sizes of. F. 692, p. 380.

Piers, Columns. F. 721.3.

Pipe, Wrought Iron—Dim. F. 696.5, see 697.412, p. 387.

Plans and Specifications. F. 692.

Plastering. F. 693.9.

Plastering, Rules for Measurement. p. 341.

Plumbing. F. 696.3.

Prisons and Reformatories. F. 725.6.

Protective Coatings for Various Structural Materials. 295, Vol. XIII.

Protective, Preservative and Decorative Covering (Painting, Wall Hanging, Glazing, Floor Covering). F. 698, p. 325.

Public Buildings. F. 725.

Pulleys, to Calculate Speed of. F. 621.85, p. 296, Vol. XIII.

Radiation. F. 697.45.

Reinforced Concrete. F. 693.6.

Reinforced Concrete, Rules of Measurement. 211.

Reinforced, Strength of. p. 272, Vol. XIII.

Reinforcement, Tables of. By B. E. Winslow. F. 696.12, p. 272, Vol. XIII.

Reinforcing Bars, specifications for. p. 197, Vol. XXI.

Reservoirs for Storage and Service. F. 696.413.

Roofing and Roofing Material. Vol. XII, F. 695, p. 215, 281.

Roofing Composition, Specifications for. p. 301, Vol. XVII.

Roots. Square. p. 367.

Safe Strength of Wood. Table of. 287.

Safe Strength of Iron & Steel in pounds per square inch. p. 361.

Sanitary Equipment, Illumination. F. 696.

Sanitary or Plumbing Ordinances. p. 174, Vol. IX.

Scagliola. F. 693.91.

Schedule of Professional Charges. p. 31.

Sewerage. F. 696.2.

Sewer Grades. F. 696.2, p. 388.

Sewers, Design and Construction. F. 696.2, pp. 287-288.

Sewer Pipes, Discharge of. F. 696.2, p. 388.

Sheet Metal. F. 695.2, p. 382.

Single Stairs. Data. F. 698.13, p. 325.

Shingles, Wood. F. 695.1, Vol. XI.

Slate. F. 695.25, p. 300.

Tile. F. 695.26.

Sidewalks and Vault Covering. Vol. XII, p. 189.

Slating—Memoranda. F. 695.25, p. 386.

Smoke Flues and Prevention. F. 697.8, p. 287, Vol. XI.

Smoke Inspection, Rules of. Vol. XII, p. 185, Vol. XV.

Specifications. F. 692.3.

Stables, Dimensions of. F. 728.941, p. 285, Vol. XV.

Stained Glass Design. F. 729.8.

Stains, Creosote. F. 698.13, p. 325.

Stair Building. F. 694.8.

Stairs. F. 694.8.

Stairs—Table for Calculating Treads and Risers. F. 692.1, p. 376.

Stairs, Table Treads and Risers of. p. 376.

Steam Heating. F. 697.42, p. 279.

Hints and Formulae. pp. 279-293.

Contractors for. pp. 276-293.

Steam Mains, Sizes of. F. 697.42, p. 294, also 235, also Vol. XI, 287.

Steel Building Const. p. 165, Vol. VII, p. 163, Vol. V.

Steel and Iron, Corrosion of. F. 691.7, p. 276. See Vol. XI.

Steel Structural. p. 291, Vol. XVII.

Stone, Suggestions for Setting. p. 373.

Stone Voids, Settlement and Weight of, Crushed. p. 193, Vol. XII.

Strains Defined. F. 620.1, p. 197, Vol. XIV.

Strengthened Beams. F. 694.3.

Strength of Concrete, Table of. 359.

Strength of Masonry, Table of. 360.

Strength of Materials. F. 620.1, 267.

Wood, Joist and Timber. p. 278.

Mechanics of Materials. p. 227, Vol. XVI.

Cast Iron and Steel Base-Plates, p. 219, Vol. XIII.

Reinforced Concrete Beams and Columns. pp. 239-247. See Vol. XI for Talbot Formula.

100 lbs. Live Floor Load.

Stress in Materials. p. 197, Vol. XIV.

Structural Materials—Cement and Steel—Specifications. p. Vol. XV.

Structural Work, Painting. 259, Vol. XIII.

Structural Steel for Buildings, Standard Specifications for. p. 191, Vol. XIV.

Subject, Index for Filing. p. 401.

Swimming Tanks. F. 692, p. 380.

Tables, Metric. p. 366.

Tables, Misc. Measure of. F. 389, pp. 368-369.

Tanks, Swimming. p. 380.

Terra Cotta Construction. F. 693.3.

Terra Cotta, Details for Hanging. p. 375.

Timber, Contents in. F. 694, p. 385.

Timber, Structural, Specifications for. p. 237, Vol. XVI.

Tin Roofs—Data. F. 695.9, p. 386.

Transmission Machinery. F. 621.8, p. 271, also 249, Vol. XI.

Transportation and Storage. F. 725.3.

Treads and Risers. F. 692.1, p. 376.

Trigonometry. F. 514.

Useful Arts. F. 600.

Varnish. p. 249-251.

Vault Covers and Sidewalks, Vol. XII, p. 189.

Vehicles, Sizes of. F. 728.942, p. 377.

Voids in Crushed Stone. Vol. XI, p. 259.

Walls. F. 721.2.

Water—Expansion—Wt. and Tests. p. 367.

Water Pressure at Different Elevations. p. 367.

Water, Pure Tests for. p. 388.

Weights and Measures. p. 264, Vol. XII.

Weights of Building Materials. F. 691, p. 368-369.

Windows, Bays, Angles of. F. 692.1, p. 379.

Wind, Velocity of. F. 389, p. 264, Vol. XII.

Wind Bracing in Steel Skeleton Construction. p. 253.

Wiring Specifications, Suggestion on. p. 259, Vol. XVI.

Wood, Finishing of. p. 255, Vol. XIII.

Wood in Pounds Per Sq. Inch, Ultimate and Safe Strength of. 358.

Wooden Buildings, Preservation of Exterior of. p. 223, Vol. XIV.

Woods, Weight of. r. 691.1, pp. 294-295.

Yellow Pine Beams, Loads in Pounds. pp. 356-357.

CLASSIFIED LIST OF ADVERTISERS.

Advertisers are classified with a view to furnish Architects and others a ready reference list of houses engaged in the Building Business. Besides the Index to Advertisements on pages 429-431, the number of the pages on which the Advertisements appear follows directly after each name Classified in this list. It is requested that those using it will kindly mention this book in their correspondence.

AIR COMPRESSORS.

Am. Steam Pump Co., 53 W. Jackson 312
Gallaher & Speck, 215 W. Congress St. 302

AIR WASHERS AND PURIFIERS.

Batterman Truitt Co., 18 E. Kinzie St. 312
Blomfeldt & Rapp Co., 108 N. Jefferson 284
Consolidated Eng. Co., 28 Pl. & Shields 284
Gustafson, K. A., 2110 N. Springfield Av. 298
Iroquois Eng. Co., 343 S. Dearborn 306
Monarch Ventilating Co., 1414 N. Halsted. 302
Narowetz Heating & Ventilating Co., 223 W. Lake St. 298
New York Blower Co., 337 W. 25th Pl. Inside Front Cover.
Webster, Warren & Co., Monadnock. 294

ALPHABETICAL AND CHANGEABLE DIRECTORIES.

Tablet & Ticket Co., (Willsons) 624 W. Adams St. 226

ANGLES AND CHANNELS.

American Bridge Co., 208 S. La Salle St. 252
Angert Wire & Iron Wks., 6028 Grove Av. 254
Bolter's A., Sons, Ward St. & Belden Av. 252
Braun, J. G., 609 S. Paulina St. 272
Butler St. Fdry. & Iron Co., 3422 Normal 262
Holmes, Pyott & Co., 159 N. Jefferson. 258
Jennet Bridge & Iron Wks., 3541 Shields. 338
Kenwood Bridge Co., 1st Nat. Bk. Bldg. 256
Morava Constr. Co., 122 S. Michigan. 256
South Halsted St. Iron Wks., 2607 S. Halsted St. 258
Union Fdry Wks., 38 S. Dearborn St. 256
Vierling Steel Wks., 23rd & Stewart 268

ARCHITECTURAL IRON WORK.

American Bridge Co., 208 S. La Salle St. 252
Angert Wire & Iron Wks., 6028 Grove Av. 254
Bolter's A., Sons, Ward St. & Belden Av. 252
Braun, J. G., 609 S. Paulina St. 272
Butler St. Fdry. & Iron Co., 3422 Normal 262
Central Arch'l Iron Wks., 3105 W. 27th. 260
Chgo. Architectural Bronze Co., 519 W. Van Buren St. 260
Chgo. Ornamental Iron Co., 37 & Stewart 260
Columbia Wire & Iron Wks., 1929 W. Lake 260
Duffin Iron Co., 4001 Wentworth Av. 268
Federal Iron Wks., 30 N. La Salle St. 251
Guaranty Iron & Wire Co., 2847 W. Lake 268
Halsted, Joseph, Co., 1233 W. Randolph. 256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves. 258
Heath-Johnson Co., 306 W. Ontario 266
Holmes, Pyott & Co., 159 N. Jefferson. 258
Jennet Bridge & Iron Wks., 3541 Shields. 338
Kenwood Bridge Co., 1st Nat. Bk. Bldg. 256
Lally Column Co., 4001 Wentworth Av. 268
Reder Fdry. Co., 2125 Canalport Av. 266
Smith, F. P. W. & I. Wks., 56 W. Lake. 258
South Halsted St. Iron Wks., 2607 S. Halsted St. 258
Standard Tyler Co., 2420 W. 15th St. 266
Sullivan-Korber Co., 2137 W. 21st Pl. 266
Union Fdry Wks., 38 S. Dearborn St. 256
Vierling Steel Wks., 23rd & Stewart 268
Winslow Bros. Co., 4600 W. Harrison St. 262
Woodbridge Ornamental Iron Co. 160 W. Erie 262

ARCHITECTURAL SCULPTORS.

Architectural Dec. Co., 1600 S. Jefferson 316
Decorators Sup. Co., 2547 Archer Av. 338
Dux, Joseph, 2112 W. Van Buren St. 346
Tudor, J. T., 455 W. Chicago Av. 346
Zettler, A., 458 N. Sangamon St. 346

ARCHITECTURAL AND STRUCTURAL IRON AND STEEL.

American Bridge Co., 208 S. La Salle St. 252
Angert Wire & Iron Wks., 6028 Grove Av. 254
Bolter's A., Sons, Ward St. & Belden Av. 252
Butler St. Fdry. & Iron Co., 3422 Normal 262
Cent'l Iron Wks. of Chgo., 959 W. Lake 262
Halsted, Joseph, Co., 1233 W. Randolph. 256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves. 258
Heath-Johnson Co., 306 W. Ontario 266
Holmes, Pyott & Co., 159 N. Jefferson. 258
Jennet Bridge & Iron Wks., 3541 Shields. 338
Kenwood Bridge Co., 1st Nat. Bk. Bldg. 256
Lally Column Co., 4001 Wentworth Av. 268
Morava Constr. Co., 122 S. Michigan. 256
Reder Fdry. Co., 2125 Canalport Av. 266
Smith, F. P. W. & I. Wks., 56 W. Lake. 258
South Halsted St. Iron Wks., 2607 S. Halsted St. 258
Standard Tyler Co., 2420 W. 15th St. 266
Union Fdry Wks., 38 S. Dearborn St. 256
Vierling Steel Wks., 23rd & Stewart 268
Wendnagel & Co., 22nd & Jefferson 270

ARCHITECTURAL TERRA COTTA.

Advance Terra Cotta Co., 29 S. La Salle 246
Am. Terra Cotta & Ceramic Co., 122 S. Mich. 246
Midland Terra Cotta Co., 11 S. La Salle. 40
Northwestern Terra Cotta Co., 2525 Clyb'rn 10

ASBESTOS FIREPROOF LUMBER.

Johns-Manville, H. W. Co., 18th & Mich. 330

ASBESTOS MANUFACTURERS.

Cent'l Asbestos & Magnesia Co., 214 W. Grand Av. 330
Johns-Manville, H. W. Co., 18th & Mich. 330
Krez, Paul J., Co., 444 N. La Salle St. 330
Watson, H. F. Co., 319 Wells St. 330

ASBESTOS PACKING.

Cent'l Asbestos & Magnesia Co., 214 W. Grand Av. 330
Krez, Paul J., Co., 444 N. La Salle St. 330

ASBESTOS—PIPE AND BOILER COVERING.

Cent'l Asbestos & Magnesia Co., 214 W. Grand Av. 330
Johns-Manville, H. W. Co., 18th & Mich. 330
Krez, Paul J., Co., 444 N. La Salle St. 330
Watson, H. F. Co., 319 Wells St. 330

ASH CONVEYORS.

Alvey Mfg. Co., 327 S. La Salle St. 274
Webster Engineering Co., 30 N. La Salle 336
Weller Mfg. Co., 1920 N. Kostner Ave. 336

ASPHALT FLOORS.

Blome-Sinek Co., 139 N. Clark St. 52
Simpson Constr. Co., 133 W. Wash. 236

ASPHALT SHINGLES.

Amalgamated Roofing Co., 431 S. Dear. 224
Beckman-Dawson Co., 19 S. La Salle St. 328
Bird & Son, 53 W. Jackson 181.
Patent Vulcanite Roofing Co., 2256 W. 49th 34

AUTOMATIC ELEVATORS.

Alvey Mfg. Co., 327 S. La Salle St. 274

AUTOMATIC PARCEL AND PROVISION BOXES.

Union Welded Products Co., 521 W. Jackson 2

AUTOMATIC SPRINKLING SYSTEMS.

H. L. Malleable Iron Co., 1801 Diversey 318

AWNINGS—BRONZE, WOOD AND IRON.

Dodge, H. B. & Co., 332 S. Michigan Av. 214

AWNINGS—CANVAS.

Walger Awning Co., 215 W. Ohio St. 226

BANKERS.

Ch. Ex. N. Bk. 134 S. La. Salle	26
G. W. Bk. & Trst. Co. 9 S. La. Salle	220

BANK AND OFFICE FIXTURES.

Ch. Sw. Bldg. Co. 623 S. Wabash	8
W. W. & West Mfr. Co. 310 N. Ada	352

BAR BENDERS

Ch. W. J. K. Bldg. Co. 124 S. W. Jackson Blvd.	244
Ch. W. J. K. Bldg. Co. 124 S. W. Jackson Blvd.	244

BAR SPACERS

Ch. W. J. K. Bldg. Co. 124 S. W. Jackson Blvd.	244
Ch. W. J. K. Bldg. Co. 124 S. W. Jackson Blvd.	244

BARS—IRON AND STEEL.

Am. Bldg. Co. 208 S. La. Salle St.	252
Ch. W. J. K. Bldg. Co. 124 S. W. Jackson Blvd.	244
Ch. W. J. K. Bldg. Co. 124 S. W. Jackson Blvd.	244

BEAMS AND COLUMNS—IRON AND STEEL

Am. Bldg. Co. 208 S. La. Salle St.	252
Am. Bldg. Co. 208 S. La. Salle St.	252
Am. Bldg. Co. 208 S. La. Salle St.	252
Am. Bldg. Co. 208 S. La. Salle St.	252
Am. Bldg. Co. 208 S. La. Salle St.	252
Am. Bldg. Co. 208 S. La. Salle St.	252
Am. Bldg. Co. 208 S. La. Salle St.	252
Am. Bldg. Co. 208 S. La. Salle St.	252
Am. Bldg. Co. 208 S. La. Salle St.	252
Am. Bldg. Co. 208 S. La. Salle St.	252

BEDS—DISAPPEARING.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BEDS—WALL.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BELT AND HAND POWER ELEVATORS.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BILLIARD ROOM SUPPLIES.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BILLIARD TABLES.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BLACK PLATE.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BLOWER REGULATORS.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BLUE AND BLACK PRINTING.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BOILERS—HOT WATER—GAS HEATING

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BOILERS—STEAM AND HOT WATER.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BOILERS—STRAIGHT AND DOWN DRAFT.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BONDS.

Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Am. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BOWLING ALLEYS.

Brunswick-Baile-Collender Co. 623 S. Wabash Av.	6
Pick. Albert & Co. 1200 W. 35th St.	226

BOXES—PARCEL AND PROVISION—AUTOMATIC.

Ch. W. Bldg. Co. 124 S. W. Jackson Blvd.	244
Ch. W. Bldg. Co. 124 S. W. Jackson Blvd.	244

BRACKETS.

Everson, C. G. & Co. 70 W. Lake St.	210
Warren, Walter G. & Co. 1401 W. Jackson	210
Williamson, R. & Co. 609 W. Wash.	210

BRASS AND IRON—ARCHITECTURAL.

Angert Wire & Iron Wks. 6028 Grove Av.	254
Chgo. Architectural Bronze Co. 519 W. Van Buren St.	250
Chgo. Ornamental Iron Co. 37 & Stewart	250
Columbia Wire & Iron Wks. 1929 W. Lake	250
Federal Iron Wks. 30 N. La. Salle St.	254
Guaranty Iron & Wire Co. 2847 W. Lake	254
Harsted, Joseph, Co. 1233 W. Randolph	256
Harke Iron & Wire Wks. N. Albany & W. Chgo. Aves.	258
Heitz, Johnson Co. 366 W. Ontario	256
Smith, F. P. W. & L. Wks. 56 W. Lake.	258
Standard Tyler Co. 2426 W. 15th St.	256
Sullivan-Korber Co. 2437 W. 21st Pl.	256
Winslow Bros. Co. 4600 W. Harrison St.	252
Woodbridge-Ornamental Iron Co. 400 W. Erie	262

BRICK BUILDING RAISERS AND MOVERS.

Friedstedt, L. P. Chgo. Tribune Bldg.	78
---------------------------------------	----

BRICK—COMMON.

Am. Brick Co. 111 W. Washington St.	244
Carey Brick Co. 133 W. Washington St.	244
Ill. Brick Co. 111 W. Washington St.	244
Western Brick Co. Danville, Ill.	244

BRICK—ENAMELED.

Western Brick Co. Danville, Ill.	244
----------------------------------	-----

BRICK—FACING.

Garden City Sand Co. 133 W. Wash.	242
Western Brick Co. Danville, Ill.	244

BRICK—FIRE.

Carey Brick Co. 133 W. Washington St.	244
Dea, Wm. E. Co. 39 N. La. Salle St.	242
Garden City Sand Co. 133 W. Wash.	242
Johnson, E. V. & Co. E. Jackson Blvd.	258
Rosier, Aspid. Co. 111 W. Monroe St.	242
Western Brick Co. Danville, Ill.	244

BRICK—PAVING.

Carey Brick Co. 133 W. Washington St.	244
Garden City Sand Co. 133 W. Wash.	242
Western Brick Co. Danville, Ill.	244

BRICK—PRESSED.

Western Brick Co. Danville, Ill.	244
----------------------------------	-----

BRICK SAND MOULD

Western Brick Co. Danville, Ill.	244
----------------------------------	-----

BRICK SEWER.

Am. Brick Co. 111 W. Washington St.	244
Carey Brick Co. 133 W. Washington St.	244
Ill. Brick Co. 111 W. Washington St.	244
Western Brick Co. Danville, Ill.	244

BRIDGES AND ROOFS.

American Bridge Co. 208 S. La. Salle St.	252
Janet Bridge & Iron Wks. 3541 Shields.	328
Kenwood Bridge Co. 1st Nat. Bk. Bldg.	256
Monarch Constr. Co. 122 S. Michigan.	256

BRONZE WORK.

Chgo. Architectural Bronze Co. 519 W. Van Buren St.	250
Chgo. Ornamental Iron Co. 37 & Stewart	250
Harsted, Joseph, Co. 1233 W. Randolph	256
Heitz, Johnson Co. 366 W. Ontario	256
Smith, F. P. W. & L. Wks. 56 W. Lake.	258
Standard Tyler Co. 2426 W. 15th St.	256
Sullivan-Korber Co. 2437 W. 21st Pl.	256
Winslow Bros. Co. 4600 W. Harrison St.	252
Woodbridge-Ornamental Iron Co. 400 W. Erie	262

BUILDING BOARD.

Bird & Son 33 W. Jackson Bl.	325
Chgo. Wood Products Co. 175 West Jackson Bldg.	175
Chgo. Wood Products Co. 175 West Jackson Bldg.	175

BUILDING DIRECTORIES.

Talbot & Co. 624 W. Adams St.	226
-------------------------------	-----

BUILDERS' HARDWARE.

Chgo. & La. Bldg. Hdw. Co. 14 W. Randolph	212
---	-----

BUILDING LOANS.

Baird & Warner, 29 S. La Salle St.	220
Corn Exec. Nat'l Bank, 134 S. La Salle	36
Greenebaum Sons Bank & Trust Co., 9 S. La Salle St.	220

BUILDING MATERIALS.

Brownell Improvement Co., 133 W. Wash.	236
Dee, Wm. E. Co., 30 N. La Salle St.	242
Garden City Sand Co., 133 W. Wash.	242
Hydraulic Sand & Transit Co., Otis Bldg.	242
Northwestern Terra Cotta Co., 2525 Clyb'n Bldg.	10
Rosing, Astrid S., 111 W. Monroe St.	242

BUILDING PAPERS.

Barrett Mfg. Co., 19 S. La Salle St.	22
Bird & Son, 53 W. Jackson Bl.	328
Cent'l Asbestos & Magnesite Co., 214 W. Grand Av.	330
Krez, Paul J., Co., 444 N. La Salle St.	330
Patent Vulcanite Roofing Co., 2256 W. 49.	34
Union Insulating Co., 20 W. Jackson Blvd	328
Watson, H. F. Co., 319 Wells St.	330

BUILDING RAISERS AND MOVERS.

Friestedt, L. P. Co., Tribune Bldg.	78
-------------------------------------	----

BULLETIN BOARDS.

Tablet & Ticket Co., (Willsons) 624 W. Adams St.	226
--	-----

CABINET WORK.

Brunswick-Balke-Clender Co., 623 S. Wabash Av.	6
Schweizer & West Mfg. Co., 310 N. Ada.	352

CANDELABRA.

Everson, C. G. & Co., 70 W. Lake St.	210
Warren, Walter G. & Co., 1401 W. Jackson	210
Williamson, R. & Co., 609 W. Wash.	210

CANOPIES—IRON AND BRONZE.

Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
Standard Tyler Co., 2420 W. 15th St.	266
Winslow Bros. Co., 4600 W. Harrison St.	262

CARPENTER CONTRACTORS.

Anderson, A. & E. Co., 19 S. La Salle St.	48
Anderson-Stevens Co., 30 N. La Salle St.	52
Anderson & Lind Mfg. Co., 2127 Iowa St.	352
Appel, Henry L. Co., 179 W. Wash.	54
Balkin Constr. Co., 53 W. Jackson Bl.	54
Barnard, H. B., 140 S. Dearborn St.	52
Bulley & Andrews, 25 N. Dearborn St.	72
Burke, Frank, 35 S. Dearborn St.	74
B. W. Constr. Co., 10 S. La Salle Street	58
Cadenhead Co., 30 N. La Salle St.	50
Carter, W. G. Co., 133 W. Washington St.	58
Casey Constr. Co., 8 S. Dearborn St.	70
Chaney-Archibald Co., 189 W. Madison St.	74
Clark, C. Everett Co., 69 W. Wash. St.	46
Doherty, Frank E., 133 W. Washington	58
Dowling & Rutherford, 51 W. Randolph	62
Dunning, W. N. Constr. Co., 10 S. La Salle	76
Eriesson, Henry Co., 139 N. Clark St.	211
Fuller, Geo. A. Co., Marquette Bldg.	44
Gindele, Chas. W. Co., 3333 La Salle St.	70
Griffiths, John & Son Co., 112 W. Adams	42
Hanson Bros. Co., 127 N. Dearborn St.	62
Jeffrey, John, Co., 127 N. Dearborn St.	70
Johnson, Chas. R. & Sons, 111 W. Wash.	74
Jones Constr. Co., 1718 W. Madison St.	72
Kalchbrenner, J., 133 W. Washington St.	64
Kirkland Constr. Co., 133 W. Wash. St.	64
Krahl Construction Co., 62 W. Madison.	54
Ledgerwood, A. J. Co., 337 W. Madison.	48
Leonard Constr. Co., 332 S. Michigan.	42
Lindell, Gust., 1325 Granville Av.	76
Lynch, Austin J. Co., 111 W. Monroe St.	52
Martin Constr. Co., 82 W. Washington.	64
Mavor, Wm., Co., 72 W. Adams St.	44
McKeown Bros., 4817 Cottage Grove Av.	74
McLennan Constr. Co., 20 N. Michigan Av.	50
Menke-Thielberg Co., 139 N. Clark St.	48
Meyne, Gerhard E., 127 N. Dearborn St.	66
Moreland, H. D. Co., 723 Reaper Bldg.	58
Moses, C. A. Constr. Co., 133 W. Wash.	56
Mutual Constr. Co., 155 N. Clark St.	68
Naylor, Thomas, Co., 111 W. Washington	64
Nicholson-Zimmerman Co., 133 W. Wash.	50
Olson, J. E., 111 W. Washington St.	68
Olson, Peter, Co., 19 S. La Salle St.	60
Paschen Bros., 111 W. Washington St.	56
Regnell, B. J. Co., 19 S. La Salle St.	66

Rosenthal, O. W., & Co., 80 E. Jackson.	72
Rauen, Math., 111 W. Washington St.	60
Salomon-Waterton Co., 343 S. Dearborn	60
Samuelson, A. J., 189 W. Madison St.	76
Scharmer Constr. Co., 139 N. Clark St.	60
Schmidt Bros. Constr. Co., 105 N. Clark.	56
Shedden, James & Co., 106 N. La Salle.	46
Simmons, J. L. Co., 4239 W. Madison St.	50
Snyder, J. W. Co., 122 S. Michigan Av.	44
Sollitt, Ralph & Sons, Constr. Co., 149 S. Dearborn St.	54
Sollitt, Sumner, Co., 79 E. Adams St.	46
Spiering, Ed., 105 N. Clark St.	72
Stewart, James & Co., 119 S. Dearborn.	42
Stiles, Geo. W. Constr. Co., Rookery.	66
Strandberg, E. P. Co., 5010 S. Wabash	56
Thompson-Starrett Co., 175 W. Jackson	44
Thomson, Geo. & Son Co., 30 N. La Salle St.	68
Todd, James & Co., 19 S. La Salle St.	66
Waldman Constr. Co., 154 W. Randolph St.	76
Wells Bros. Co., 53 W. Jackson Bl.	42
Wilson, R. F. & Co., 154 W. Randolph	48

CARPETS AND RUGS.

Pick, Albert & Co., 1200 W. 35th St.	226
--------------------------------------	-----

CARPING.

Dux, Joseph, 2112 W. Van Buren St.	316
------------------------------------	-----

CASEMENT ADJUSTERS.

Wilkins, George Lester, 7057 N. Clark St.	272
---	-----

CAST IRON FENCE POSTS.

Reeder Fdry. Co., 2125 Canalport Av.	266
Smith, F. P. W. & I. Wks., 56 W. Lake.	258

CASTINGS—GENERAL.

Butler St. Fdry. & Iron Co., 3422 Normal	262
Reeder Fdry. Co., 2125 Canalport Av.	266

CEILING LIGHTS.

Everson, C. G. & Co., 70 W. Lake St.	210
Warren, Walter G. & Co., 1401 W. Jackson	210
Williamson, R. & Co., 609 W. Wash.	210

CEILINGS—ORNAMENTAL STEEL.

Krisely Bros., 28th Pl. & 5th Av.	274
McFarland & Hyde Co., 2761 S. 5th Av.	28
Stear, Frank, 1473 N. Halsted St.	274

CEILINGS—SUSPENDED, GROINED AND ARCHED.

Nat'l Fire Proofing Co., 327 S. La Salle.	238
---	-----

CEMENT COATING.

Wadsworth Howland Co., 225 N. Carpenter	324
---	-----

CEMENT — DUPLEX FLASHING BLOCK.

Renaud, F. D., 545 W. 31st St.	224
--------------------------------	-----

CEMENT—MANUFACTURERS.

Chgo. Portland Cement Co., 30 N. La Salle	246
de Smet, Geo. W., 133 W. Washington	236
German American Portland Cement Co., 140 S. Dearborn St.	240
Marquette Cement Mfg. Co., 140 S. Dear.	240
Utica Hydraulic Cement Co., 53 W. Jack.	240

CEMENT—PORTLAND.

Chgo. Portland Cement Co., 30 N. La Salle	246
de Smet, Geo. W., 133 W. Washington	236
Garden City Sand Co., 133 W. Wash.	242
German American Portland Cement Co., 140 S. Dearborn St.	240
Marquette Cement Mfg. Co., 140 S. Dear.	240
Rosing, Astrid S., 111 W. Monroe St.	242

CEMENT SIDEWALKS, PAVING AND FLOORS.

Blome-Sinck Co., 139 N. Clark St.	52
Simpson Constr. Co., 133 W. Wash.	236

CEMENT TESTING.

Hunt, Robt. W. & Co., Ins. Exe. Bldg.	344
---------------------------------------	-----

CHAIRS FOR CAFES AND HOTELS, PUBLIC BUILDINGS.

Newton & Holt Co., 1018 S. Wabash' Av.	44
--	----

CHANDELIERS.

Everson, C. G. & Co., 70 W. Lake St.	210
Warren, Walter G. & Co., 1401 W. Jackson	210
Williamson, R. & Co., 609 W. Wash.	210

CHANGEABLE DIRECTORIES AND BULLETINS.

Tablet & Ticket Co., (Willsons) 624 W. Adams St.	226
--	-----

CHEMISTS.

Hunt, Robt. W. & Co., Ins. Exe. Bldg.	344
---------------------------------------	-----

CHIMNEYS.

Heine Chimney Co., 123 W. Madison St.	240
---------------------------------------	-----

CHIMNEY TOPS.

Northwestern Terra Cotta Co., 2525 Clyb'rn 10

CHIMNEYS FOR FACTORIES.

Heine Chimney Co., 123 W. Madison St. 246

**CHIMNEYS FOR PUMPING STATIONS,
ELECTRIC PLANTS, SCHOOLS AND
ASYLUMS, ETC.**

Heine Chimney Co., 123 W. Madison St. 246

CISTERNS.

Wendnagel & Co., 22nd & Jefferson Sts. 270

CLOCKS—TOWER.

Johnson Service Co., 177 N. Dearborn. 291

CLOSET SEATS.Brunswick-Balke-Collender Co., 623 S.
Wabash Av. 6**CLOTHES DRYERS.**

Chgo. Dryer Co., 630 S. Wabash Av. 212

Troy Laundry Mch'y. Co., 23rd & La Salle 212

**CLUSTERS, WIRELESS—STANDARD
AND SEPARABLE.**

Benjamin Elec. Mfg. Co., 120 S. Sangamon 202

COAL AND ASH HANDLING MACHINERY.

Alvey Mfg. Co., 327 S. La Salle St. 274

Webster Engineering Co., 30 N. La Salle 336

Weller Mfg. Co., 1820 N. Kostner Av. 336

COAL CHUTES AND COAL HOLES.

Smith, F. P. W. & I. Wks., 56 W. Lake. 258

COLUMNS, STEEL—CONCRETE FILLED.

Lally Column Co., 1001 Wentworth Av. 268

**COMPOSITION FOR EXTERIOR AND
INTERIOR—ORNAMENTAL**

Architectural Dec. Co., 1600 S. Jefferson 316

Decorators Sup. Co., 2547 Archer Av. 338

Tudor, J. T., 455 W. Chicago Av. 346

Zettler, A., 458 N. Sangamon St. 346

COMPUTING DEVICE.

Tomlinson, H. W., 61 E. Van Buren St. 353

CONCRETE CONSTRUCTION.

Barton Spider-Web System, 178 W. Jackson 232

Blome-Sinek Co., 139 N. Clark St. 52

Chaney-Archibald Co., 189 W. Madison St. 74

Jones Constr. Co., 1748 W. Madison St. 72

Meyne, Gerhardt F., 127 N. Dearborn St. 66

Raymond Concrete Pile Co., 111 W. Monroe 236

Simpson Constr. Co., 133 W. Wash. 236

Stewart, James & Co., 110 S. Dearborn. 42

Trussed Concrete Steel Co., 122 S. Mich. 234

Wilson, R. E. Co., 154 W. Randolph 48

**CONCRETE CONSTRUCTION—FLAT
SLAB.**

Barton Spider-Web System, 178 W. Jackson 232

Concrete Steel Co., 53 W. Jackson Bl. 264

Flat Slab Patents Co., 332 S. Michigan. 232

Trussed Concrete Steel Co., 122 S. Mich. 234

CONCRETE PILES.

Raymond Concrete Pile Co., 111 W. Monroe 236

CONCRETE REINFORCING BARS STEEL.

Concrete Steel Co., 53 W. Jackson Blvd. 264

Smith, F. P. W. & I. Wks., 56 W. Lake. 258

Trussed Concrete Steel Co., 122 S. Mich. 234

**CONCRETE REINFORCING STEEL
FABRIC.**Northwestern Expanded Metal Co., 407
S. Dearborn St. 18**CONDUCTORS FOR LIGHTNING.**

Arrow Conductor & Mfg. Co., 1536 W. Adams 78

CONDUITS.

Hazard Mfg. Co., 552 W. Adams St. 34

Standard Power Equip. Co., 53 W. Jack. 312

**CONDUITS—UNDERGROUND—STEAM
PIPES.**

Standard Power Equip. Co., 53 W. Jack. 312

CONTRACTORS' BONDS.Builders & Mfrs. Mutual Casualty Co.,
133 W. Washington St. 26

Chgo. Bonding & Surety Co., 29 S. La Salle 12

Mass. Bonding & Ins. Co., 175 W. Jackson. 220

National Surety Co., 209 S. La Salle St. 220

Sherman & Ellis, Inc., 29 S. La Salle St. 4

CONVEYORS—SPIRAL STEEL.

Alvey Mfg. Co., 327 S. La Salle St. 274

Webster Eng. Co., 30 N. La Salle St. 336

Weller Mfg. Co., 1820 N. Kostner Av. 336

CONTRACTORS AND BUILDERS.

Anderson, A. & E. Co., 19 S. La Salle St. 48

Anderson-Stevens Co., 30 N. La Salle St. 52

Appel, Henry L. Co., 179 W. Wash. 54

Balkin Constr. Co., 53 W. Jackson Bl. 54

Barnard, H. B., 140 S. Dearborn St. 52

Bulley & Andrews, 25 N. Dearborn St. 72

Burke, Frank, 35 S. Dearborn St. 74

B. W. Constr. Co., 10 S. La Salle Street 58

Cadenhead Co., 30 N. La Salle St. 50

Carter, W. G. Co., 133 W. Washington St. 58

Casey Constr. Co., 8 S. Dearborn St. 70

Chaney-Archibald Co., 189 W. Madison St. 74

Clark, C. Everett Co., 69 W. Wash. St. 46

Doherty, Frank E., 133 W. Washington 58

Dowling & Rutherford, 54 W. Randolph 62

Dunning, W. N. Constr. Co., 10 S. La Salle 76

Eriesson, Henry Co., 139 N. Clark St. 214

Fuller, Geo. A. Co., Marquette Bldg. 44

Gindele, Chas. W. Co., 3333 La Salle St. 70

Griffiths, John & Son Co., 112 W. Adams 42

Hanson Bros. Co., 127 N. Dearborn St. 62

Jeffrey, John, Co., 127 N. Dearborn St. 70

Jensen & Steenhil, 105 S. Dearborn St. 62

Johnson, Chas. B. & Sons, 111 W. Wash. 74

Jones Constr. Co., 1748 W. Madison St. 72

Kalehbroenner, J., 133 W. Washington St. 64

Kirkland Constr. Co., 133 W. Wash. St. 64

Krahl Construction Co., 62 W. Madison. 54

Lanquist & Hilsley Co., 1100 N. Clark St. 46

Ledgerwood, A. J. Co., 327 W. Madison. 48

Leonard Constr. Co., 332 S. Michigan. 42

Lindell, Gust., 1325 Granville Av. 76

Lynch, Austin J. Co., 111 W. Monroe St. 52

Martin Constr. Co., 82 W. Washington. 64

Mayor, Wm. Co., 72 W. Adams St. 44

McKeown Bros., 4817 Cottage Grove Av. 74

McLennan Constr. Co., 30 N. Michigan Av. 50

Menke-Thielberg Co., 139 N. Clark St. 48

Meyne, Gerhardt F., 127 N. Dearborn St. 66

Moreland, H. D. Co., 723 Reaper Bldg. 58

Moses, C. A. Constr. Co., 133 W. Wash. 56

Mutual Constr. Co., 155 N. Clark St. 68

Naylor, Thomas, Co., 111 W. Washington. 64

Nicholson-Zimmerman Co., 133 W. Wash. 50

Olson, J. E., 111 W. Washington St. 68

Olson, Peter, Co., 19 S. La Salle St. 60

Paschen Bros., 111 W. Washington St. 56

Regnell, B. J. Co., 19 S. La Salle St. 66

Rodatz, Jacob, The Rookery. 62

Rosenthal, O. W. & Co., 86 E. Jackson. 72

Rauen, Math., 111 W. Washington St. 60

Salomon-Waterson Co., 343 S. Dearborn 60

Samuelson, A. J., 189 W. Madison St. 76

Scharmer Constr. Co., 139 N. Clark St. 60

Schmidt Bros. Constr. Co., 105 N. Clark. 56

Shedden, James & Co., 106 N. La Salle. 46

Simmons, J. L. Co., 4239 W. Madison St. 50

Snyder, J. W. Co., 122 S. Michigan Av. 41

Solliitt, Ralph & Sons, Constr. Co., 140 S.
Dearborn St. 54

Solliitt, Sumner, Co., 79 E. Adams St. 76

Spiering, Ed., 105 N. Clark St. 72

Stewart, James & Co., 110 S. Dearborn. 12

Stiles, Geo. W. Constr. Co., Rookery. 66

Strandberg, E. P. Co., 5010 S. Wabash 56

Thompson-Starratt Co., 175 W. Jackson 44

Thomson, Geo. & Son Co., 30 N. La Salle St. 68

Todd, James & Co., 19 S. La Salle St. 66

Waldman Constr. Co., 154 W. Randolph St. 76

Wells Bros. Co., 53 W. Jackson Bl. 42

Wilson, R. E. & Co., 154 W. Randolph 48

**CONTRACTORS FOR LIGHTNING CON-
DUCTORS.**

Arrow Conductor & Mfg. Co., 1536 W. Adams 78

CONTRACTORS—ELEVATORS

Saggen Derrick Co., Grand & Albany 336

Thomas Elevator Co., 20 S. Hoyne Av. 336

CONTRACTORS—WIRE ROPE.

Hazard Mfg. Co., 552 W. Adams St. 34

CONVEYORS—BELT.

Alvey Mfg. Co., 327 S. La Salle St. 274

Weller Mfg. Co., 1820 S. Hoyne Ave. 336

CONVEYORS GRAVITY.

Alvey Mfg. Co., 327 S. La Salle St. 274

Webster Engineering Co., 30 N. La Salle 336

**CONVEYING AND ELEVATING
MACHINERY.**

Alvey Mfg. Co., 327 S. La Salle St. 274

Webster Engineering Co., 30 N. La Salle 336

COOKING APPARATUS.

Peoples Gas Light & Coke Co., Michigan
Av. & Adams St. 218

COOLING SYSTEMS FOR BUILDINGS.

Batterman Truitt Co., 18 E. Kinzie St. 312
Blomfeldt & Rapp Co., 108 N. Jefferson 284
Consolidated Eng. Co., 28 Pl. & Shields 284
Gustafson, K. A., 2110 N. Springfield Av. 298
Monarch Ventilating Co., 1414 N. Halsted. 302
Narowitz Heating & Ventilating Co., 223
W. Lake St. 298
New York Blower Co., 337 W. 25th Pl.
Inside Front Cover.
Webster, Warren & Co., Monadnock. 294

COPING.

Northwestern Terra Cotta Co., 2525 Clyb'm 10

CORNICE WORK.

Advance Roofing & Sheet Metal Wks.,
4830 Cottage Grove Ave. 274
Gustafson, K. A., 2110 S. Springfield 298
Knisely Bros., 28th Pl. & 5th Av. 274
McFarland & Hyde Co., 2701 S. 5th Av. 8
Staer, Frank, 1473 N. Halsted St. 274

CORNICES—COPPER, GALVANIZED.

Advance Roofing & Sheet Metal Wks.,
4830 Cottage Grove Ave. 274
Gustafson, K. A., 2110 S. Springfield 298
Knisely Bros., 28th Pl. & 5th Av. 274
McFarland & Hyde Co., 2701 S. 5th Av. 8
Staer, Frank, 1473 N. Halsted St. 274

COWLES.

Kernchen Co., 332 S. Michigan Av. 338

CRUSHED STONE.

Brownell Improvement Co., 133 W. Wash. 236

CRUSHED STONE SCREENINGS.

Brownell Improvement Co., 133 W. Wash. 236

CURB GUARDS—CONCRETE.

Concrete Steel Co., 53 W. Jackson Blvd. 264

CURBING—OOLITIC LIME STONE.

Indiana Quarries Co., 112 W. Adams St. 1

CUT STONE CONTRACTORS.

Indiana Quarries Co., 112 W. Adams St. 1
McMillan, W. & Son, 10 S. La Salle St.
Inside Front Cover.
Stein-Ebertshaeuser & Co., 1017 West
Madison St. 250
Ward, Albert J. Co., Fullerton Ave. Bridge 40

CUTLERY AND TOOLS.

Orr & Lockett Hdw. Co., 14 W. Randolph 212
Pick, Albert & Co., 1200 W. 35th St. 226

DAMP RESISTING COMPOUNDS.

Barrett Mfg. Co., 10 S. La Salle St. 22
Ceresit Waterproofing Co., 110 S. Dear. 230
de Smet, Geo. W., 133 W. Washington 236
Imperial Water Proof Co., 105 W. Monroe 230
Seofield, Evans & Co., 24 E. 8th St. 234

DEADENING FELT—QUILT.

Cabot, Samuel, 24 W. Kinzie St. 328

DEADENING MATERIAL.

Barrett Mfg. Co., 10 S. La Salle St. 22
Bird & Son, 53 W. Jackson Bl. 328
Cabot, Samuel, 24 W. Kinzie St. 328
Johns-Manville, H. W. Co., 18th & Mich. 330
Union Insulating Co., 20 W. Jackson Blvd 328
Watson, H. E. Co., 319 Wells St. 330

DECORATORS.

Gleich, T. C., 2860 Broadway. 326
Noelle, J. B. Co., 702 Wells St. 326
Spierling & Linden, 1216 Michigan Av. 326
Sullivan, J. P., 4515 Indiana Av. 326

DECORATORS—INTERIOR

Gleich, T. C., 2860 Broadway. 326
Noelle, J. B. Co., 702 Wells St. 326
Spierling & Linden, 1216 Michigan Av. 326
Sullivan, J. P., 4515 Indiana Av. 326

DERRICKS—PORTABLE AND STATIONARY.

Sasgen Derrick Co., Grand & Albany Ays. 336
Thomas Elevator Co., 20 S. Hoyne Ave. 336

DIRECTORIES.

Tablet & Ticket Co., (Willsons) 624 W.
Adams St. 226

DOOR HANGERS—BALL BEARING NOISELESS.

Smith, F. P. W. & I. Wks., 56 W. Lake. 258
Winslow Bros. Co., 4600 W. Harrison St. 262

DOORS.

Anderson & Lind Mfg. Co., 2127 Iowa St. 352
Curtis Door & Sash Co., 1414 S. Western 18
Morgan Sash & Door Co., 2287 Blue
Island Av. Inside Back Cover.
Nollau & Wolff Mfg. Co., 1705 Fullerton. 352

DOORS—AUTOMATIC.

Nat. Auto. Door Co., 175 W. Jackson Blvd. 16

DOORS—CROSS HORIZONTAL FOLDING.

Variety Mfg. Co., 2958 Carroll Av. 270

DOORS—CROSS IMPROVED MEAKER.

Variety Mfg. Co., 2958 Carroll Av. 270

DOORS—FLUSH VENEERED

Curtis Door & Sash Co., 1414 S. Western 18
Morgan Sash & Door Co., 2287 Blue
Island Av. Inside Back Cover.

DOORS—HOLLOW METAL.

Hill, O. J. Co., 2253 St. Paul Ave. 214
Knisely Bros., 28th Pl. & 5th Av. 271
McFarland & Hyde Co., 2701 S. 5th Ave. 8
Nat. Auto. Door Co., 175 W. Jackson Blvd. 16
Saino Fire Door & Shutter Co., 2925
Elston Ave. 270
Variety Mfg. Co., 2958 Carroll Ave. 270

DOOR MATS—RUBBER AND STEEL

Pick, Albert & Co., 1200 W. 35th St. 226
Smith, F. P. W. & I. Wks., 56 W. Lake. 258

DOORS—PANIC PROOF.

Nat. Auto. Door Co., 175 W. Jackson Blvd. 16

DOORS—SAFETY.

Nat. Auto. Door Co., 175 W. Jackson Blvd. 16

DOORS—SELF LOCKING.

Nat. Auto. Door Co., 175 W. Jackson Blvd. 16

DOORS—SLIDING SWING.

Dodge, H. B. & Co., 332 S. Michigan Av. 214
Smith, F. P. W. & I. Wks., 56 W. Lake. 258

DOORS—VENEERED.

Curtis Door & Sash Co., 1414 S. Western 18
Morgan Sash & Door Co., 2287 Blue
Island Av. Inside Back Cover.

DRAINAGE.

Am. Heating & Plumbing Corp., 54 W. Rand 288
Corboy, M. J. Co., 178 W. Randolph St. 308
Daly, J. J., 408 Wells St. 296
Dwyer & Co., 31 W. Illinois St. 300
Hanley-Casey Mech. Equip. Co., 410 W.
Ohio St. 306
Henrich, Geo. A., 5650 Broadway. 300
Murphy Plumbing Co., 23 E. Congress St. 308
Nacey, P. Co., 927 S. State St. 292
Nelson, R. J. Co., 836 W. Adams St. 308
Nilson Bros., 3222 N. Halsted St. 288
Nilson, G. Albin, 329 N. Clark St. 310
Noble & Thumm, 2313 Lincoln Av. 310
Stein, Carl John, Co., 853 S. State St. 304

DRAIN BASE.

Stannard Power Equip. Co., 53 W. Jack. 312

DRAWERIES.

Spierling & Linden, 1216 Michigan Av. 326

DRAWING MATERIALS.

Am. Blue Print Paper Co., 335 Plymouth 331

DRUG FIXTURES.

Brunswick-Balke-Tollender Co., 623 S.
Wabash Av. 6

DRY ROOMS.

Chgo. Dryer Co., 630 S. Wabash Av. 212
Kehm Bros. Co., 15 W. Kinzie St. 290
Troy Laundry Mch. Co., 23rd & La Salle 212

DUMB WAITERS.

Matot, D. A., 1538 Montana St. 212

DUMB WAITERS—ELECTRIC AND HAND POWER.

Matot, D. A., 1538 Montana St. 212
Webster Engineering Co., 30 N. La Salle 336

DYNAMOS.

Commonwealth Edison Co., 72 W. Adams 208
Comstock, L. K. & Co., 30 N. Michigan 200
Halligan, Eugene J., 162 N. Desplaines St. 206
Hewitt, J. B. & Co., 10 S. La Salle St. 206
Hoffman Electric Co., 3711 Ogden Av. 204
Hub Electric Co., 1819 Carroll Av. 204
Kausal, Benedict A., 565 W. Washington. 204
Lamont, L. H. & Co., 9 S. Clinton St. 202
McFell Signal Co., 2857 S. Halsted St. 202
Newgard, Henry, & Co., 917 Wash. Blvd. 200
Pierce Electric Co., 215 W. Randolph St. 206
White City Elect. Co., 11 N. Franklin 200

ENAMELS

Adams & Elting Co., 716 Washington Bl.	324
Chgo. Varnish Co., 2100 Elston Av.	322
Murphy Varnish Co., 50 W. 22nd St.	322
Pratt & Lambert, 320 W. 26th St.	322
Standard Varnish Wks., 2606 Federal	320
Union Insulating Co., 20 W. Jackson Blvd	328

ENAMELING—STEEL.

Am. Sheet & Tin Plate Co., 208 S. La Salle St. and Pittsburgh, Pa.	28
--	----

ELECTRIC BELLS AND LIGHTING.

Benjamin Elec. Mfg. Co., 120 S. Sangamon	202
Commonwealth Edison Co., 72 W. Adams	208
Comstock, L. K. & Co., 30 N. Michigan	200
Halligan, Eugene J., 162 N. Desplaines St.	206
Hewitt, J. B. & Co., 19 S. La Salle St.	206
Hoffman Electric Co., 3711 Ogden Av.	204
Hub Electric Co., 1819 Carroll Av.	204
Kausal, Benedict A., 565 W. Washington.	204
Lamont, L. H. & Co., 9 S. Clinton St.	202
McFell Signal Co., 2857 S. Halsted St.	202
Newgard, Henry, & Co., 947 Wash. Blvd.	200
Pierce Electric Co., 215 W. Randolph St.	206
Wadford Electric Co., 175 W. Jackson	204
White City Elect. Co., 14 N. Franklin	200

ELECTRIC CONDUITS AND FITTINGS.

Cuthbert Electrical Mfg. Co., 725 Fulton	200
--	-----

ELECTRIC ELEVATORS.

Kaestner & Hecht Co., 500 S. Throop St.	264
Otis Elevator Co., 600 W. Jackson Blvd.	32

ELECTRIC FIXTURES.

Benjamin Elec. Mfg. Co., 120 S. Sangamon	202
Comstock, L. K. & Co., 30 N. Michigan	200
Everson, C. G. & Co., 70 W. Lake St.	210
Hewitt, J. B. & Co., 19 S. La Salle St.	206
Kausal, Benedict A., 565 W. Washington.	204
Lamont, L. H. & Co., 9 S. Clinton St.	202
McFell Signal Co., 2857 S. Halsted St.	202
Pierce Electric Co., 215 W. Randolph St.	206
Wadford Electric Co., 175 W. Jackson	204
Warren, Walter G. & Co., 1401 W. Jackson	210
Williamson, R. & Co., 609 W. Wash.	210

ELECTRIC MOTORS.

Commonwealth Edison Co., 72 W. Adams	208
Comstock, L. K. & Co., 30 N. Michigan	200
Halligan, Eugene J., 162 N. Desplaines St.	206
Hewitt, J. B. & Co., 19 S. La Salle St.	206
Hoffman Electric Co., 3711 Ogden Av.	204
Hub Electric Co., 1819 Carroll Av.	204
Kausal, Benedict A., 565 W. Washington.	204
Lamont, L. H. & Co., 9 S. Clinton St.	202
McFell Signal Co., 2857 S. Halsted St.	202
Newgard, Henry, & Co., 947 Wash. Blvd.	200
Pierce Electric Co., 215 W. Randolph St.	206
White City Elect. Co., 14 N. Franklin	200

ELECTRIC SWITCHES.

Crockett, W. P. Co., 411 S. Jefferson St.	202
Cuthbert Electrical Mfg. Co., 725 Fulton	200

ELECTRIC SWITCHBOARDS, PANEL BOARDS.

Cuthbert Electrical Mfg. Co., 725 Fulton	200
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ELECTRICAL APPARATUS AND SUPPLIES.

Benjamin Elec. Mfg. Co., 120 S. Sangamon	202
Commonwealth Edison Co., 72 W. Adams	208
Comstock, L. K. & Co., 30 N. Michigan	200
Crockett, W. P. Co., 411 S. Jefferson St.	202
Cuthbert Electrical Mfg. Co., 725 Fulton	200
Halligan, Eugene J., 162 N. Desplaines St.	206
Hewitt, J. B. & Co., 19 S. La Salle St.	206
Hoffman Electric Co., 3711 Ogden Av.	204
Hub Electric Co., 1819 Carroll Av.	204
Kausal, Benedict A., 565 W. Washington.	204
Lamont, L. H. & Co., 9 S. Clinton St.	202
McFell Signal Co., 2857 S. Halsted St.	202
Newgard, Henry, & Co., 947 Wash. Blvd.	200
Pierce Electric Co., 215 W. Randolph St.	206
Wadford Electric Co., 175 W. Jackson	204
White City Elect. Co., 14 N. Franklin	200

ELECTRICAL CONSTRUCTION.

Commonwealth Edison Co., 72 W. Adams	208
Comstock, L. K. & Co., 30 N. Michigan	200
Crockett, W. P. Co., 411 S. Jefferson St.	202
Cuthbert Electrical Mfg. Co., 725 Fulton	200
Halligan, Eugene J., 162 N. Desplaines St.	206
Handley-Casey Mech. Equip. Co., 410 W. Ohio St.	306
Hewitt, J. B. & Co., 19 S. La Salle St.	206

Hoffman Electric Co., 3711 Ogden Av.	204
Hub Electric Co., 1819 Carroll Av.	204
Kausal, Benedict A., 565 W. Washington.	204
Lamont, L. H. & Co., 9 S. Clinton St.	202
McFell Signal Co., 2857 S. Halsted St.	202
Newgard, Henry, & Co., 947 Wash. Blvd.	200
Pierce Electric Co., 215 W. Randolph St.	206
Wadford Electric Co., 175 W. Jackson	204
White City Elect. Co., 14 N. Franklin	200

ELECTRICAL FUSES.

Cuthbert Electrical Mfg. Co., 725 Fulton	200
Johns-Manville, H. W. Co., 18th & Mich.	330

ELECTRICAL HOUSE LIGHTING SUPPLIES.

Williamson, R. & Co., 609 W. Wash. St.	210
--	-----

ELEVATING AND CONVEYING MACHINERY.

Alvey Mfg. Co., 327 S. La Salle St.	274
Webster Engineering Co., 30 N. La Salle	336
Weller Mfg. Co., 1820 N. Kostner Av.	336

ELEVATOR CABLES.

Gallaher & Speck, 215 W. Congress St.	302
Hazard Mfg. Co., 552 W. Adams	34

ELEVATOR DOORS AND ENCLOSURES.

Central Arch'l Iron Wks., 3105 W. 27th	260
Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Chgo. Ornamental Iron Co., 37 & Stewart	260
Columbia Wire & Iron Wks., 1929 W. Lake	260
Duffin Iron Co., 4001 Wentworth Av.	268
Federal Iron Wks., 30 N. La Salle St.	254
Gallaher & Speck, 215 W. Congress St.	302
Guaranty Iron & Wire Co., 2847 W. Lake	268
Halsted, Joseph, Co., 1233 W. Randolph.	256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258

Heath, O. H. Co., 306 W. Ontario	266
Hill, O. H. Co., 2253 St. Paul Av.	214
Saino Fire Door & Shutter Co., 2025 Elston	270
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
Standard Tyler Co., 2420 W. 15th St.	266
Sullivan-Korber Co., 2437 W. 21st Pl.	266
Union Fdry Wks., 38 S. Dearborn St.	256
Vierling Steel Wks., 23rd & Stewart	268
Winslow Bros. Co., 4600 W. Harrison St.	262
Woodbridge Ornamental Iron Co., 400 W. Erie	262

ELEVATOR FIRE DOORS.

Hill, O. H. Co., 2253 St. Paul Av.	214
Kinnear Mfg. Co., 208 S. La Salle St.	270
Standard Tyler Co., 2420 W. 15th St.	266

ELEVATOR FLOOR INDICATORS.

Standard Tyler Co., 2420 W. 15th St.	266
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ELEVATORS—LIGHT.

Alvey Mfg. Co., 327 S. La Salle St.	274
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ELEVATOR MACHINERY.

Gallaher & Speck, 215 W. Congress St.	302
Kaestner & Hecht Co., 500 S. Throop St.	264
Otis Elevator Co., 600 W. Jackson Blvd.	32

ELEVATORS—PASSENGER AND FREIGHT.

Gallaher & Speck, 215 W. Congress St.	302
Kaestner & Hecht Co., 500 S. Throop St.	264
Otis Elevator Co., 600 W. Jackson Blvd.	32

ELEVATOR REPAIRS.

Gallaher & Speck, 215 W. Congress St.	302
Kaestner & Hecht Co., 500 S. Throop St.	264
Otis Elevator Co., 600 W. Jackson Blvd.	32

ELEVATORS—BUILDING MATERIAL.

Sasgen Derrick Co., Grand & Albany Aves.	336
Thomas Elevator Co., 20 S. Hoyne Av.	336

ENGINES.

Kaestner & Hecht Co., 500 S. Throop St.	264
---	-----

ENGINE BEDS.

Flome-Sinck Co., 139 N. Clark St.	52
Simpson Constr. Co., 133 W. Wash.	236

ENGINEERS.

Hunt, Robt. W. & Co., Ins. Exe. Bldg.	334
Kilgore, W. B. Constr. Co., 1272 W. North	254
Shankland, E. C. & R. M., 209 S. La Salle.	334

ENGINEERS—CIVIL.

Greeley-Howard-Norlin Co., 30 N. La Salle	216
Jones, W. D., 8 S. Dearborn St.	216
Silander, A. I., 30 N. La Salle St.	216
Suhr & Berryman, 139 N. Clark St.	216

ENGINEERS—CONSULTING.	
Hunt, Robt. W. & Co., Ins. Ex. Bldg.	334
Shankland, E. C. & R. M., 209 S. La Salle.	334
ENGINEERS—CONTRACTING.	
Flat Slab Patents Co., 332 S. Michigan.	232
Jennet Bridge & Iron Wks., 3541 Shields.	238
Jensen & Steenhil, 105 S. Dearborn St.	62
Kenwood Bridge Co., 1st Nat. Bk. Bldg.	256
Morava Constr. Co., 122 S. Michigan.	256
Shankland, E. C. & R. M., 209 S. La Salle.	334
Stewart, James & Co., 110 S. Dearborn.	42
ENGINEERS—ELECTRICAL.	
Comstock, L. K. & Co., 30 N. Michigan.	200
Hanley-Casey Mech. Equip. Co., 410 W. Ohio St.	306
Kausal, Benedict A., 565 W. Washington.	204
Lamont, L. H. & Co., 9 S. Clinton St.	202
Pierce Electric Co., 215 W. Randolph St.	206
Wadeford Electric Co., 175 W. Jackson.	204
ENGINEERS—LANDSCAPE.	
Wittbold, Geo. Co., 737 Buckingham	222
ENGINEERS—MATERIAL HANDLING MACHINERY.	
Alvey Mfg. Co., 327 S. La Salle St.	274
Webster Engineering Co., 30 N. La Salle	336
Weller Mfg. Co., 1820 N. Kostner Ave.	336
ENGINEERS—STRUCTURAL.	
Barton Spider-Web System, 178 W. Jackson	232
Kilgore, W. B. Constr. Co., 1272 W. North	254
Morava Constr. Co., 122 S. Michigan.	256
Shankland, E. C. & R. M., 209 S. La Salle.	334
EXCAVATING.	
Chgo. Foundation Co., 105 W. Monroe St.	70
Ottenhoff, Conrad, 1214 S. Leavitt St.	68
EXHAUST FANS.	
Batterman Truitt Co., 18 E. Kinzie St.	312
Consolidated Eng. Co., 28 Pl. & Shields	284
Hayward, R. B. Co., 406 W. Erie St.	304
Mellish-Hayward Co., 213 W. Austin Av.	298
New York Blower Co., 337 W. 25th Pl.	
Inside Front Cover.	
Variety Mfg. Co., 2958 Carroll Av.	270
EXPANDED METAL CONCRETE REINFORCEMENT.	
Northwestern Expanded Metal Co., 407 S. Dearborn St.	18
EXPANSION TANKS.	
Kroeschell Bros. Co., 440 W. Erie St.	290
EXTERIOR COVERING FOR HOUSES.	
Garden City Sand Co., 133 W. Wash.	242
Natl Kellastone Co., 19 S. La Salle St.	238
FANS—BLOWER—EXHAUSTERS.	
Batterman Truitt Co., 18 E. Kinzie St.	312
Consolidated Eng. Co., 28 Pl. & Shields	284
New York Blower Co., 337 W. 25th Pl.	
Inside Front Cover.	
FEED WATER HEATERS.	
Webster, Warren & Co., Monadnock.	294
FILTERS.	
Everson, C. G. & Co., 70 W. Lake St.	210
FIRE ALARMS & SIGNALING SYSTEMS.	
McFell Signal Co., 2857 S. Halsted St.	202
Wadeford Electric Co., 175 W. Jackson	204
FIRE APPARATUS.	
Allen, W. D. Mfg. Co., 133 W. Lake St.	222
FIRE BRICK AND CLAY.	
Dee, Wm. E. Co., 30 N. La Salle St.	242
Garden City Sand Co., 133 W. Wash.	242
Johnson E. V., 80 E. Jackson Blvd.	238
Rosing, Astrid S., 111 W. Monroe St.	242
FIRE DOORS.	
Central Arch'l Iron Wks., 3105 W. 27th	260
Hill, O. H. Co., 2253 St. Paul Av.	244
Knisely Bros., 28th Pl. & 5th Av.	274
McFarland & Hyde Co., 2701 S. 5th Av.	8
McMillan, James & Co., 33 N. Market St.	316
Nat. Auto. Door Co., 175 W. Jackson Blvd.	16
Saino Fire Door & Shutter Co., 2025 Elston	270
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
Variety Mfg. Co., 2958 Carroll Av.	270
FIRE DOORS FOR ELEVATORS.	
Hill, O. H. Co., 2253 St. Paul Av.	244
FIRE ESCAPES.	
Central Arch'l Iron Wks., 3105 W. 27th	260
Cent'l Iron Wks. of Chgo., 939 W. Lake	262
Halsted, Joseph, Co., 1233 W. Randolph.	256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
Union Fdry Wks., 38 S. Dearborn St.	256
Vierling Steel Wks., 23rd & Stewart	268
FIRE EXTINGUISHERS.	
Allen, W. D. Mfg. Co., 133 W. Lake St.	222
FIRE HOSE.	
Allen, W. D. Mfg. Co., 133 W. Lake St.	222
FIRE PROTECTION TANKS.	
Wendnagel & Co., 22nd & Jefferson Sts.	270
FIRE WINDOWS.	
Am. Steel Window Co., 332 S. Michigan	272
Knisely Bros., 28th Pl. & 5th Av.	274
Lupton, David, Sons Co., 175 W. Jackson	38
McFarland & Hyde Co., 2701 S. 5th Av.	8
Staar, Frank, 1173 N. Halsted St.	274
FIREPLACES.	
Colonial Fire Place Co., 4611 W. 12th.	38
Interior Tiling Co., 21 E. Van Buren St.	248
FIREPLACE FURNISHINGS, ETC.	
Colonial Fire Place Co., 4611 W. 12th.	38
Interior Tiling Co., 21 E. Van Buren St.	248
FIREPLACES—WOOD—BRICK & TILE.	
Colonial Fire Place Co., 4611 W. 12th.	38
FIREPROOF LOCKERS.	
Federal Steel Fixture Co., 189 W. Madison	272
FIREPROOF PAINT.	
Barrett Mfg. Co., 10 S. La Salle St.	22
Ceresit Waterproofing Co., 110 S. Dear.	230
Imperial Water Proof Co., 105 W. Monroe	230
Moore, Benjamin & Co., 415 N. Green.	224
Scotfield, Evans & Co., 24 E. 8th St.	234
Wadsworth Howland Co., 225 N. Carpenter	324
FIREPROOF PARTITIONS.	
Dee, Wm. E. Co., 30 N. La Salle St.	242
Johnson E. V., 80 E. Jackson Blvd.	238
Natl Fire Proofing Co., 327 S. La Salle.	238
Rosing, Astrid S., 111 W. Monroe St.	242
U. S. Gypsum Co., 205 W. Monroe St.	20
FIREPROOF SASH AND FRAMES.	
Knisely Bros., 28th Pl. & 5th Av.	274
McFarland & Hyde Co., 2701 S. 5th Av.	8
Staar, Frank, 1173 N. Halsted St.	274
FIREPROOF SHUTTERS AND DOORS.	
Dodge, H. B. & Co., 332 S. Michigan Av.	244
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Hill, O. H. Co., 2253 St. Paul Av.	244
Kinnear Mfg. Co., 208 S. La Salle St.	270
Saino Fire Door & Shutter Co., 2025 Elston	270
FIREPROOFING.	
Johnson E. V., 80 E. Jackson Blvd.	238
Natl Fire Proofing Co., 327 S. La Salle.	238
Northwestern Expanded Metal Co., 407 S. Dearborn St.	18
Rosing, Astrid S., 111 W. Monroe St.	242
U. S. Gypsum Co., 205 W. Monroe St.	20
FIXTURES—STEEL.	
Federal Steel Fixture Co., 189 W. Madison	272
FLANGED FITTINGS.	
Jenkins Bros., 300 W. Lake St.	282
FLASHING BLOCKS.	
Renaud, F. D., 515 W. 31st St.	224
FLOOR COVERINGS.	
Bird & Son, 53 W. Jackson Bl.	328
Natl Kellastone Co., 19 S. La Salle St.	238
N. Y. Bolding & Packing Co., 124 W. Lake St.	222
FLOORS—NOISELESS—JOINTLESS—DUSTLESS.	
Williams-Wendt Co., 118 N. La Salle St.	250
FLOORING—HARDWOOD.	
Burns, J. E. Lumber Co., 700 W. Chicago	350
Hines, Edw. Lumber Co., 2431 S. Lincoln	24
North Branch Flooring Co., 2415 Barry.	350
Rittenhouse & Embree Co., 3500 S. Racine.	348
Schillo, Adam, Lumber Co., Kingsbury & Blackhawk Sts.	350
Thornton-Claney Lumber Co., 2315 Elston	26
Wilce, T. Co., 2209 S. Throop St.	348

FLOORING—COMPOSITION.

Natl Kellastone Co., 19 S. La Salle St. 238
Williams & Wendt Co., 118 N. La Salle 250

FLOORING—HOSPITALS, INSTITUTIONS AND PUBLIC PLACES.

Natl Kellastone Co., 19 S. La Salle St. 238
Williams-Wendt Co., 118 N. La Salle St. 250

FLOORS—SANITARY.

Natl Kellastone Co., 19 S. La Salle St. 238
Williams-Wendt Co., 118 N. La Salle St. 250

FLOORING WOOD BLOCK.

Dodge, H. B. & Co., 332 S. Michigan Av. 211

FLUE LININGS.

Dee, Wm. E. Co., 30 N. La Salle St. 242
Garden City Sand Co., 133 W. Wash. 242
Johnson E. V., 80 E. Jackson Blvd. 238
Rosing, Astrid S., 111 W. Monroe St. 242

FORGINGS.

American Bridge Co., 208 S. La Salle St. 252
Jennet Bridge & Iron Wks., 3511 Shields. 338
Kenwood Bridge Co., 1st Nat. Bk. Bldg. 256

FOUNDATIONS.

Chgo. Foundation Co., 105 W. Monroe St. 70

FOUNDATIONS—CONCRETE.

Chgo. Foundation Co., 105 W. Monroe St. 70
Raymond Concrete Pile Co., 111 W. Monroe 236

FOUNDERS.

Angert Wire & Iron Wks., 6028 Grove Av. 251

FRAMES—IRON DOOR.

Braun, J. G., 609 S. Paulina St. 272

FRAMES—WINDOW AND DOOR.

Anderson & Lind Mfg. Co., 2127 Iowa St. 352
Curtis Door & Sash Co., 1414 S. Western 18
Morgan Sash & Door Co., 2287 Blue Island Av. Inside Back Cover.
Nollan & Wolff Mfg. Co., 1705 Fullerton. 352

FRICTION CLUTCHES.

Kaestner & Hecht Co., 509 S. Throop St. 264
Weller Mfg. Co., 1820 N. Kostner Av. 336

FURNACES.

Eureka Smokeless Furnace Co., 105 S. La Salle St. 282
Hayward, R. B. Co., 406 W. Erie St. 304
McMillan, James & Co., 33 N. Market St. 316
Mellich-Hayward Co., 213 W. Austin Av. 298
Mueller, L. J. Furnace Co., 182 N. Dear. 316
Reynolds, L. F. & Co., 412 N. Dearborn. 316
Robinson Furnace Co., 205 W. Lake St. 316

FURNACES—SMOKELESS.

Eureka Smokeless Furnace Co., 105 S. La Salle St. 282
McMillan, James & Co., 33 N. Market St. 316
Robinson Furnace Co., 205 W. Lake St. 316

FURNITURE.

Newton & Hoyt Co., 1018 S. Wabash Av. 14

FURNITURE FOR BANKS—LIBRARIES OFFICES—STORES—CAFES—CLUBS — HOTELS—COURT HOUSES AND PUBLIC BUILDINGS.

Newton & Hoyt Co., 1018 S. Wabash Av. 14

FURNITURE, SPECIAL DESIGN.

Newton & Hoyt Co., 1018 S. Wabash Av. 14
Spierling & Lindon, 1216 Michigan Av. 326

FURNITURE UPHOLSTERED.

Newton & Hoyt Co., 1018 S. Wabash Av. 14

GALVANIZING—ELECTRO.

Braseo Mfg. Co., 1455 S. Michigan Av. 6
Kawner Mfg. Co., 11 S. La Salle St. 4
Zoult Brown Metals Co., 38 S. Dearborn St. 1

GALVANIZED IRON.

Kelsely Bros., 2801 Pl. & 5th Av. 274
Stam, Frank, 1473 N. Halsted St. 271

GARBAGE CREMATORIES.

Herbert Boller Co., Hoyt & La Salle Sts. 318
Ketter Incinerator Co., 175 W. Jackson 78
Keweenaw Boller Co., 328 W. Washington & Keweenaw, Ill. 276-277

GAS AND ELECTRIC FIXTURES.

Everson, C. G. & Co., 70 W. Lake St. 210
Waller, Walter G. & Co., 1401 W. Jackson 210
Wildmison, R. & Co., 609 W. Wash. St. 210

GAS FITTING.

Am. Heating & Plumbing Corp., 54 W. Rand 288
Corboy, M. J. Co., 178 W. Randolph St. 308
Daly, J. J., 408 Wells St. 296
Dwyer & Co., 31 W. Illinois St. 300
Farwell, E. J., 410 S. Sherman St. 308
Henrich, Geo. A., 5650 Broadway. 300
Murphy Plumbing Co., 23 E. Congress St. 308
Nacey, P. Co., 827 S. State St. 292
Nelson, R. J. Co., 836 W. Adams St. 308
Nilson Bros., 2222 N. Halsted St. 288
Nilson, G. Albin, 329 N. Clark St. 310
Noble & Thumm, 2313 Lincoln Av. 310
Stein, Carl John, Co., 853 S. State St. 304

GAS—ILLUMINATING.

Peoples Gas Light & Coke Co., Michigan Av. & Adams St. 218

GAS HEATING—HOT WATER EQUIPMENT.

Economy Heater Co., 108 S. La Salle St. 280

GAS LOGS AND GAS GRATES.

Colonial Fire Place Co., 4611 W. 12th. 38
Interior Tiling Co., 21 E. Van Buren St. 248

GAS MACHINES.

Johnson Service Co., 177 N. Dearborn. 294

GAS—NATURAL.

Peoples Gas Light & Coke Co., Michigan Av. & Adams St. 218

GAS RANGES.

Peoples Gas Light & Coke Co., Michigan Av. & Adams St. 218
Pick, Albert & Co., 1200 W. 35th St. 226

GAS STOVES.

Peoples Gas Light & Coke Co., Michigan Av. & Adams St. 218
Pick, Albert & Co., 1200 W. 35th St. 226

GAS WATER HEATERS.

Economy Heater Co., 108 S. La Salle St. 280

GENERAL CONTRACTORS.

Anderson, A. & E. Co., 19 S. La Salle St. 48
Anderson-Stevens Co., 30 N. La Salle St. 52
Appel, Henry L. Co., 179 W. Wash. 54
Balkin Constr. Co., 53 W. Jackson Bl. 54
Barnard, H. B., 140 S. Dearborn St. 52
Bulley & Andrews, 25 N. Dearborn St. 72
Burke, Frank, 35 S. Dearborn St. 74
B. W. Constr. Co., 10 S. La Salle Street 58
Cad-head Co., 30 N. La Salle St. 50
Carter, W. G. Co., 133 W. Washington St. 58
Casey Constr. Co., 8 S. Dearborn St. 70
Chaney-Archibald Co., 189 W. Madison St. 74
Clark, C. Everett Co., 69 W. Wash. St. 46
Doherty, Frank E., 133 W. Washington 58
Dowling & Rutherford, 54 W. Randolph 62
Dunning, W. N. Constr. Co., 10 S. La Salle 76
Ericsson, Henry Co., 139 N. Clark St. 214
Fuller, Geo. A. Co., Marquette Bldg. 44
Gindele, Chas. W. Co., 3333 La Salle St. 70
Griffiths, John & Son Co., 112 W. Adams 42
Hanson Bros. Co., 127 N. Dearborn St. 62
Jeffrey, John, Co., 127 N. Dearborn St. 70
Jensen & Steenhill, 105 S. Dearborn St. 62
Johnson, Chas. B. & Sons, 111 W. Wash. 71
Jones Constr. Co., 1748 W. Madison St. 72
Kaltchbrenner, J., 133 W. Washington St. 64
Kilgore, W. B. Constr. Co., 1272 W. North 254
Kirkland Constr. Co., 133 W. Wash. St. 64
Kral Construction Co., 62 W. Madison. 54
Lanquist & Hilsley Co., 1100 N. Clark St. 46
Ledgerwood, A. J. Co., 337 W. Madison. 48
Leonard Constr. Co., 332 S. Michigan. 42
Lindell, Gust., 1325 Granville Av. 76
Lynch, Austin J. Co., 111 W. Monroe St. 52
Martin Constr. Co., 82 W. Washington. 64
Mavor, Wm. Co., 72 W. Adams St. 44
McKeown Bros., 4817 Cottage Grove Av. 74
McLennan Constr. Co., 30 N. Michigan Av. 50
Menke-Thielberg Co., 139 N. Clark St. 48
Meyne, Gerhardt F., 127 N. Dearborn St. 66
Moreland, H. D. Co., 723 Reaper Bk. 58
Moses, C. A., Constr. Co., 133 W. Wash. 56
Mutual Constr. Co., 155 N. Clark St. 68
Naylor, Thomas, Co., 111 W. Washington. 64
Nicholson-Zimmerman Co., 133 W. Wash. 50
Olson, J. E., 111 W. Washington St. 68

Olson, Peter, Co., 19 S. La Salle St.	60
Paschen Bros., 111 W. Washington St.	56
Regnell, B. J., Co., 19 S. La Salle St.	66
Rodatz, Jacob, The Rookery.	62
Rosenthal, O. W., & Co., 80 E. Jackson.	72
Rauen, Math., 111 W. Washington St.	60
Salomon-Waterton Co., 343 S. Dearborn	60
Samuelson, A. J., 189 W. Madison St.	76
Scharmer Constr. Co., 139 N. Clark St.	60
Schmidt Bros. Constr. Co., 105 N. Clark.	56
Shedden, James & Co., 106 N. La Salle.	46
Simmons, J. L. Co., 4239 W. Madison St.	50
Snyder, J. W. Co., 122 S. Michigan Av.	44
Sollitt, Ralph & Sons, Constr. Co., 140 S. Dearborn St.	54
Sollitt, Sumner, Co., 79 E. Adams St.	46
Spierling, Ed., 105 N. Clark St.	72
Stewart, James & Co., 110 S. Dearborn.	42
Stiles, Geo. W. Constr. Co., Rookery.	66
Strandberg, E. P. Co., 5010 S. Wabash	56
Thompson-Starratt Co., 175 W. Jackson	44
Thomson, Geo. & Son Co., 30 N. La Salle St.	68
Todd, James & Co., 19 S. La Salle St.	66
Waldman Constr. Co., 154 W. Randolph St.	76
Wells Bros. Co., 53 W. Jackson Bl.	42
Wilson, R. F. & Co., 154 W. Randolph	48

GLASS.

Am. Luxfer Prism Co., 29 E. Madison	332
-------------------------------------	-----

GLASS—ART, ORNAMENTAL AND STAINED.

Am. Luxfer Prism Co., 29 E. Madison	332
Spierling & Linden, 1216 Michigan Av.	326

GLASS—BEVELED.

Am. Luxfer Prism Co., 29 E. Madison	332
-------------------------------------	-----

GLASS—METAL LEADED FOR CEILINGS.

Spierling & Linden, 1216 Michigan Av.	326
---------------------------------------	-----

GLASS—MOSAIC.

Spierling & Linden, 1216 Michigan Av.	326
---------------------------------------	-----

GLASS—PRISMATIC.

Am. Luxfer Prism Co., 29 E. Madison	332
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GLASS—WIRE.

Mississippi Wire Glass Co., 7 W. Madison.	332
---	-----

GRAIN ELEVATOR CONTRACTORS.

Stewart, James & Co., 110 S. Dearborn.	42
--	----

GRAIN ELEVATOR MACHINERY.

Alvey Mfg. Co., 327 S. La Salle St.	274
Kaestner & Hecht Co., 500 S. Throop St.	264
Webster Eng. Co., 30 N. La Salle St.	336
Weller Mfg. Co., 1820 N. Kostner Av.	336

GRANITE FOR BUILDING PURPOSES.

Stein-Ebertshaeuser & Co., 1017 West Madison St.	250
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GRATES AND FIREPLACES.

Colonial Fireplace Co., 4611 W. 12th St.	38
Interior Tiling Co., 21 E. Van Buren St.	248

GRAVEL.

Brownell Improvement Co., 133 W. Washington St.	236
Garden City Sand & Gravel Co., 133 W. Washington	242
Hydraulic Sand & Transit Co., Otis Bldg.	242
Rosing, Astrid S., 111 W. Monroe St.	242

GRILLE WORK.

Architectural Dec. Co., 1600 S. Jefferson	346
Tudor, J. T., 455 W. Chicago Av.	346
Zettler, A., 458 N. Sangamon St.	346

GRILLE WORK—METAL.

Central Arch'l Iron Wks., 3105 W. 27th	260
Cent'l Iron Wks. of Chgo., 339 W. Lake	262
Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Chgo. Ornamental Iron Co., 37 & Stewart	260
Columbia Wire & Iron Wks., 1929 W. Lake	260
Decorators Sup. Co., 2547 Archer Av.	338
Duffin Iron Co., 4001 Wentworth Av.	268
Federal Iron Wks., 30 N. La Salle St.	251
Guaranty Iron & Wire Co., 2847 W. Lake	268
Halsted, Joseph, Co., 1233 W. Randolph	256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Heath-Johnson Co., 306 W. Ontario	266
Smith, F. P. W. & L. Wks., 56 W. Lake.	258
Standard Tyler Co., 2420 W. 15th St.	266
Sullivan-Korber Co., 2137 W. 21st Pl.	266
Union Fdry Wks., 38 S. Dearborn St.	256
Winslow Bros. Co., 4600 W. Harrison St.	262
Woodbridge Ornamental Iron Co., 400 W. Erie	262

GYPSUM PRODUCTS.

U. S. Gypsum Co., 205 W. Monroe St.	20
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HAIR FELT.

Cent'l Asbestos & Magnesia Co., 214 W. Grand Av.	330
Krez, Paul J., Co., 444 N. La Salle St.	330

HARDWARE.

Orr & Lockett Hldw. Co., 14 W. Randolph	212
---	-----

HARDWARE—BUILDERS'.

Orr & Lockett Hldw. Co., 14 W. Randolph	212
---	-----

HARDWARE SPECIALTIES.

Orr & Lockett Hldw. Co., 14 W. Randolph	212
Van Dame, W. L., 58 E. Washington St.	2

HARDWOOD FLOORING.

Burns, J. E. Lumber Co., 700 W. Chicago	350
Hines, Edw. Lumber Co., 2431 S. Lincoln	24
North Branch Flooring Co., 2415 Barry.	350
Rittenhouse & Embree Co., 3500 S. Racine.	348
Schillo, Adam, Lumber Co., Kingsbury & Blackhawk Sts.	350
Thornton-Clancy Lumber Co., 2315 Elston	26
Wilce, T. Co., The, 2209 S. Throop St.	348

HARDWOOD LUMBER.

Burns, J. E. Lumber Co., 700 W. Chicago	350
Hines, Edw. Lumber Co., 2431 S. Lincoln	24
North Branch Flooring Co., 2415 Barry.	350
Rittenhouse & Embree Co., 3500 S. Racine.	348
Schillo, Adam, Lumber Co., Kingsbury & Blackhawk Sts.	350
Thornton-Clancy Lumber Co., 2315 Elston	26
Wilce, T. Co., The, 2209 S. Throop St.	348

HEATING APPARATUS.

Am. Heating & Plumbing Corp., 54 W. Rand	288
Arcade Steam Heating Co., 126 W. Kinzie	306
Brady & Co., 125 N. Curtis St.	300
Chgo. Steam Heating Co., 169 N. Jefferson	304
Claffey, E. J. Co., 12 W. Illinois St.	288
Daly, J. J., 408 Wells St.	296
Davis, G. M., Regulator Co., 422 Milw'kee	298
Dwyer & Co., 31 W. Illinois St.	300
Economy Heater Co., 108 S. La Salle St.	280
Farwell, B. J., 410 S. Sherman St.	308
Gallaher & Speck, 215 W. Congress St.	302
Glennon-Bielke Co., 546 W. Lake St.	304
Graves Heating Co., 162 N. Desplaines	292
Gustafson, K. A., 2110 N. Springfield Av.	298
Hanley-Casey Mech. Equip. Co., 410 W. Ohio St.	306
Hayward, R. B. Co., 406 W. Erie St.	304
Henrich, Geo. A., 5650 Broadway.	300
Herbert Boiler Co., Root & La Salle Sts.	318
Herlihy, J. J., 751 W. Van Buren St.	300
Ill. Malleable Iron Co., 1801 Diversey	318
Iroquois Eng. Co., 343 S. Dearborn	306
Johnson, C. W., Inc., 611 Wash. Blvd.	296
Kehm Bros. Co., 15 W. Kinzie St.	290
Kewanee Boiler Co., 328 W. Washington & Kewanee, Ill.	276-277
Kilander, A. & Co., 126 S. Clinton St.	296
Kirk, Geo. H., 6711 Wentworth Av.	296
Klender, W. & Co., 3110 N. Clark St.	306
Kroeschell Bros. Co., 446 W. Erie St.	290
Lees, Wm., 548 Washington Blvd.	302
McDonough, E. J. Co., 19 W. Kinzie St.	302
Melish-Hayward Co., 213 W. Austin Av.	298
Monarch Ventilating Co., 1414 N. Halsted.	302
Mueller, L. J., Furnace Co., 182 N. Dear.	316
Nacey, P. Co., 927 S. State St.	292
Narowetz Heating & Ventilating Co., 223 W. Lake St.	298
Nelson, R. J., Co., 836 W. Adams St.	308
Nilson Bros., 3222 N. Halsted St.	288
Nilson, G. Albin, 329 N. Clark St.	310
Noble & Thumm, 2313 Lincoln Av.	310
Peckham, Harry, Jr., 209 Milwaukee Av.	292
Phillips, Getschow Co., 130 W. Kinzie St.	290
Pope, Wm. A., 26 N. Jefferson St.	292
Prentice, L. H., Co., 328 Sherman St.	290
Reynolds, B. F. & Co., 412 N. Dearborn.	316
Rigby, Ben, 545 W. Lake St.	310
Robinson Furnace Co., 205 W. Lake St.	316
Russell, J. E. & Co., 154 W. Randolph.	318
Scott Valve Co., 310 W. Randolph St.	314
Smith V. A. Co., 213 W. Lake St.	318
Spencer Heater Co., 80 E. Jackson Blvd.	286
Weir & Craig Mfg. Co., 2421 Wallace St.	286

HEAT REGULATION.

Annex Co., 175 W. Jackson Blvd. and Knoxville, Tenn.	310
Johnson Service Co., 177 N. Dearborn.	294
Natl Regulator Co., 208 S. Jefferson.	294
Powers Regulator Co., 5 S. Wabash Av.	294

HEATING SUPPLIES.

Am. Heating & Plumbing Corp., 54W.Rand	288
Chgo. Steam Heating Co., 169 N. Jefferson	304
Consolidated Eng. Co., 28 Pl. & Shields	284
Daly, J. J., 408 W. Wells St.	296
Davis, G. M., Regulator Co., 422 Milw'kee	298
Dwyer & Co., 31 W. Illinois St.	300
Eureka Smokeless Furnace Co., 105 S. La Salle St.	282
Glennon-Bielke Co., 546 W. Lake St.	304
Henrich, Geo. A., 5650 Broadway.	300
Herbert Boiler Co., Root & La Salle Sts.	318
Ill. Malleable Iron Co., 1801 Diversy	318
Kelm Bros. Co., 15 W. Kinzie St.	290
Kewanee Boiler Co., 328 W. Washington & Kewanee, Ill.	276-277
Kirk, Geo. H., 6711 Wentworth Av.	296
Klender, W. & Co., 3140 N. Clark St.	306
Kroeschell Bros. Co., 410 W. Erie St.	290
McDonough, E. J. Co., 19 W. Kinzie St.	302
McMillan, James & Co., 33 N. Market St.	316
Mueller, L. J., Furnace Co., 182 N. Dear.	316
Nacey, P. Co., 927 S. State St.	292
Phillips, Getschow Co., 130 W. Kinzie St.	290
Pope, Wm. A., 26 N. Jefferson St.	292
Prentice, L. H. Co., 328 Sherman St.	290
Robinson Furnace Co., 205 W. Lake St.	316
Smith V. A. Co., 213 W. Lake St.	318
Webster, Warren & Co., Monadnock.	294

HEATING—VACUUM.

Arcade Steam Heating Co., 126 W. Kinzie	306
Chicago Steam Heating Co., 169 N. Jeff.	304
Consolidated Eng. Co., 28 Pl. & Shields	284
Glennon-Bielke Co., 546 W. Lake St.	304
Klender, W. & Co., 3140 N. Clark St.	306
Noble & Thumm, 2313 Lincoln Ave.	310
Peckham, Harry, Jr., 209 Milwaukee Av.	292
Phillips, Getschow Co., 130 N. Kinzie St.	290
Russell, J. E., & Co., 154 W. Randolph.	318
Webster, Warren & Co., Monadnock.	294

HEATING VAPOR.

Arcade Steam Heating Co., 126 W. Kinzie	306
Chicago Steam Heating Co., 169 N. Jeff.	304
Glennon-Bielke Co., 546 W. Lake St.	304
Klender, W. & Co., 3140 N. Clark St.	306
Noble & Thumm, 2313 Lincoln Ave.	310
Phillips, Getschow Co., 130 N. Kinzie	290
Russell, J. E., & Co., 154 W. Randolph.	318
Smith V. A. Co., 213 W. Lake St.	318

HEATING AND VENTILATING.

Am. Heating & Plumbing Corp., 54W.Rand	288
Arcade Steam Heating Co., 126 W. Kinzie	306
Brady & Co., 125 N. Curtis St.	300
Chgo. Steam Heating Co., 169 N. Jefferson	304
Chaffey, E. J. Co., 12 W. Illinois St.	288
Daly, J. J., 408 W. Wells St.	296
Dwyer & Co., 31 W. Illinois St.	300
Farwell, B. J., 410 S. Sherman St.	308
Gallagher & Speck, 215 W. Congress St.	302
Glennon-Bielke Co., 546 W. Lake St.	304
Graves Heating Co., 162 N. Desplaines	292
Gustafson, K. A., 2110 N. Springfield Av.	298
Hanley-Casey Mech. Equip. Co., 410 W. Ohio St.	306
Hayward, R. B. Co., 406 W. Erie St.	304
Henrich, Geo. A., 5650 Broadway.	300
Herlihy, J. J., 751 W. Van Buren St.	300
Ingois Eng. Co., 313 S. Dearborn	306
Johnson, C. W., Inc., 611 Wash. Blvd.	296
Kilander, A. & Co., 126 S. Clinton St.	296
Kirk, Geo. H., 6711 Wentworth Av.	296
Kroeschell Bros. Co., 410 W. Erie St.	290
Loes, Wm., 548 Washington Blvd.	302
McDonough, E. J. Co., 19 W. Kinzie St.	302
McHring & Hanson Co., 118 N. Franklin	288
Mellish-Hayward Co., 213 W. Austin Av.	298
Monarch Ventilating Co., 1411 N. Halsted	302
Mueller, L. J., Furnace Co., 182 N. Dear.	316
Nacey, P. Co., 927 S. State St.	292
Narowetz Heating & Ventilating Co., 223 W. Lake St.	298
Nelson, R. J. Co., 836 W. Adams St.	308
Nelson Bros., 3222 N. Halsted St.	288
Nelson, G. Albin, 329 N. Clark St.	310

Peckham, Harry, Jr., 209 Milwaukee Av.	292
Phillips, Getschow Co., 130 W. Kinzie St.	290
Pope, Wm. A., 26 N. Jefferson St.	292
Prentice, L. H. Co., 328 Sherman St.	290
Reynolds, B. F., & Co., 412 N. Dearborn.	316
Rigby, Ben., 545 W. Lake St.	310
Robinson Furnace Co., 205 W. Lake St.	316
Russell, J. E., & Co., 154 W. Randolph.	318
Stein, Carl John, Co., 853 S. State St.	304

HECTOGRAPH PRINTS.

Am. Blue Print Paper Co., 335 Plymouth	334
Crofoot, Nielson & Co., 180 W. Wash.	334

HOISTING AND CONVEYING MACHINERY.

Alvey Mfg. Co., 327 S. La Salle St.	274
Webster Engineering Co., 30 N. La Salle	336
Weller Mfg. Co., 1820 N. Kostner Av.	336

HOISTS—MATERIAL.

Sasgen Derrick Co., Grand & Albany Aves.	336
Thomas Elevator Co., 20 S. Hoyne Av.	336

HOLLOW PARTITION—TILE

Dee, Wm. E. Co., 30 N. La Salle St.	242
Johnson E. V., 89 E. Jackson Blvd.	238
Natl Fire Proofing Co., 327 S. La Salle.	238
Rosing, Astrid S., 111 W. Monroe St.	242
Western Brick Co., Danville, Ill.	244

HORIZONTAL FOLDING DOORS.

Hill, O. H. Co., 2253 St. Paul Av.	214
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HOSE, RACKS AND REELS.

Allen, W. D. Mfg. Co., 133 W. Lake St.	222
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HOT BLAST HEATING APPARATUS.

Am. Heating & Plumbing Corp., 54W.Rand	288
Arcade Steam Heating Co., 126 W. Kinzie	306
Chgo. Steam Heating Co., 169 N. Jefferson	304
Daly, J. J., 408 W. Wells St.	296
Davis, G. M., Regulator Co., 422 Milw'kee	298
Dwyer & Co., 31 W. Illinois St.	300
Eureka Smokeless Furnace Co., 105 S. La Salle St.	282
Gallagher & Speck, 215 W. Congress St.	302
Gustafson, K. A., 2110 N. Springfield Av.	298
Hanley-Casey Mech. Equip. Co., 410 W. Ohio St.	306
Hayward, R. B. Co., 406 W. Erie St.	304
Henrich, Geo. A., 5650 Broadway.	300
Herlihy, J. J., 751 W. Van Buren St.	300
Kelm Bros. Co., 15 W. Kinzie St.	290
Klender, W. & Co., 3140 N. Clark St.	306
Kilander, A. & Co., 126 S. Clinton St.	296
Loes, Wm., 548 Washington Blvd.	302
McDonough, E. J. Co., 19 W. Kinzie St.	302
McMillan, James & Co., 33 N. Market St.	316
Mohring & Hanson Co., 118 N. Franklin	288
Mellish-Hayward Co., 213 W. Austin Av.	298
Monarch Ventilating Co., 1411 N. Halsted	302
Nacey, P. Co., 927 S. State St.	292
Narowetz Heating & Ventilating Co., 223 W. Lake St.	298
Phillips, Getschow Co., 130 W. Kinzie St.	290
Pope, Wm. A., 26 N. Jefferson St.	292
Prentice, L. H. Co., 328 Sherman St.	290
Robinson Furnace Co., 205 W. Lake St.	316
Smith V. A. Co., 213 W. Lake St.	318
Stein, Carl John, Co., 853 S. State St.	304

HOT WATER BOILERS—GAS HEATING.

Economy Heater Co., 108 S. La Salle St.	280
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HOT WATER HEATERS.

Arcade Steam Heating Co., 126 W. Kinzie	306
Dwyer & Co., 31 W. Illinois St.	300
Economy Heater Co., 108 S. La Salle St.	280
Glennon-Bielke Co., 546 W. Lake St.	304
Hanley-Casey Mech. Equip. Co., 410 W. Ohio St.	306
Herbert Boiler Co., Root & La Salle Sts.	318
Ill. Malleable Iron Co., 1801 Diversy	318
Kewanee Boiler Co., 328 W. Washington & Kewanee, Ill.	276-277
Kilander, A. & Co., 126 S. Clinton St.	296
Kirk, Geo. H., 6711 Wentworth Av.	296
Klender, W. & Co., 3140 N. Clark St.	306
Kroeschell Bros. Co., 410 W. Erie St.	290
Loes, Wm., 548 Washington Blvd.	302
McDonough, E. J. Co., 19 W. Kinzie St.	302
Mueller, L. J., Furnace Co., 182 N. Dear.	316
Nacey, P. Co., 927 S. State St.	292
Peckham, Harry, Jr., 209 Milwaukee Av.	292
Phillips, Getschow Co., 130 W. Kinzie St.	290

Pope, Wm. A., 26 N. Jefferson St.	292
Prentice, L. H., Co., 328 Sherman St.	290
Russell, J. E., & Co., 154 W. Randolph.	318
Smith V. A. Co., 213 W. Lake St.	318
Spencer Heater Co., 80 E. Jackson Blvd.	286
Weir & Craig Mfg. Co., 2421 Wallace St.	286

HOT WATER & STEAM HEATING.

Am. Heating & Plumbing Corp., 54W. Rand.	288
Arcade Steam Heating Co., 126 W. Kinzie	306
Brady & Co., 125 N. Curtis St.	300
Chgo. Steam Heating Co., 169 N. Jefferson	304
Claffey, E. J. Co., 12 W. Illinois St.	288
Daly, J. J., 408 W. Wells St.	296
Dwyer & Co., 31 W. Illinois St.	300
Farwell, B. J., 410 S. Sherman St.	308
Gallaher & Speck, 215 W. Congress St.	302
Glennon-Bielke Co., 546 W. Lake St.	304
Graves Heating Co., 162 N. Desplaines	292
Gustafson, K. A., 2110 N. Springfield Av.	298
Hanley-Casey Mech. Equip. Co., 410 W. Ohio St.	306
Henrich, Geo. A., 5650 Broadway.	300
Herlihy, J. J., 751 W. Van Buren St.	300
Johnson, C. W., inc., 644 Wash. Blvd.	296
Kehm Bros. Co., 15 W. Kinzie St.	290
Kilander, A. & Co., 126 S. Clinton St.	296
Kirk, Geo. H., 6711 Wentworth Av.	296
Klender, W. & Co., 3140 N. Clark St.	306
Kroeschell Bros. Co., 440 W. Erie St.	290
Lees, Wm., 548 Washington Blvd.	302
McDonough, E. J. Co., 19 W. Kinzie St.	302
Mehring & Hanson Co., 118 N. Franklin	288
Monarch Ventilating Co., 1414 N. Halsted.	302
Mueller, L. J., Furnace Co., 182 N. Dear.	316
Nacey, P. Co., 927 S. State St.	292
Narowitz Heating & Ventilating Co., 223 W. Lake St.	298
Nelson, R. J., Co., 836 W. Adams St.	308
Nilson Bros., 3222 N. Halsted St.	288
Nilson, G. Albin, 329 N. Clark St.	310
Noble & Thumm, 2313 Lincoln Av.	310
Peckham, Harry, Jr., 209 Milwaukee Av.	292
Phillips, Getschow Co., 130 W. Kinzie St.	290
Pope, Wm. A., 26 N. Jefferson St.	292
Prentice, L. H., Co., 328 Sherman St.	290
Reynolds, B. F., & Co., 412 N. Dearborn.	316
Rigby, Ben, 545 W. Lake St.	310
Robinson Furnace Co., 205 W. Lake St.	316
Russell, J. E., & Co., 154 W. Randolph.	318
Stein, Carl John, Co., 853 S. State St.	304

HOTEL SUPPLIES.

Newton & Hoyt Co., 1018 S. Wabash Av.	74
Pick, Albert & Co., 1200 W. 35th St.	226

HOUSE MOVERS AND RAISERS.

Friestedt, L. P. Co., Tribune Bldg.	78
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HUMIDITY CONTROL.

Iroquois Eng. Co., 343 S. Dearborn	306
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HYDRANTS.

Jenkins Bros., 300 W. Lake St.	282
Scott Valve Co., 310 W. Randolph St.	314

HYDRAULIC ELEVATORS.

Otis Elevator Co., 600 W. Jackson Blvd.	32
---	----

ICE CONVEYING MACHINERY.

Alvey Mfg. Co., 327 S. La Salle St.	274
Webster Engineering Co., 30 N. La Salle	336
Weller Mfg. Co., 1820 N. Kostner Ave.	336

INCINERATORS—GARBAGE.

Herbert Boiler Co., Root & La Salle Sts.	318
Kerner Incinerator Co., 175 W. Jackson	78

INDIRECT LIGHTING APPLIANCES.

Natl X-Ray Reflectors Co., 235 Jackson.	206
---	-----

INDUCED DRAFT REGULATORS.

Davis, G. M., Regulator Co., 122 Milw'kee	298
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INSPECTORS.

Hunt, Robt. W. & Co., Ins. Exc. Bldg.	334
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INSULATION—BREWERIES AND COLD STORAGE WAREHOUSES.

Natl Fire Proofing Co., 327 S. La Salle.	238
Union Insulating Co., 20 W. Jackson Blvd	328

INSULATING PAPERS.

Bird & Son, 53 W. Jackson Bl.	328
Johns-Manville, H. W. Co., 18th & Mich.	330
Union Insulating Co., 20 W. Jackson Blvd	328

INTERIOR DECORATORS.

Gleich, T. C., 2860 Broadway.	326
Noodle, J. B., Co., 702 Wells St.	326

INTERIOR FINISH.

Am. Wall Bed Co., 1339 W. 21st St.	226
Anderson & Lind Mfg. Co., 2127 Iowa St.	352
Newton & Hoyt Co., 1018 S. Wabash Av.	14
Nollau & Wolff Mfg. Co., 1705 Fullerton.	352
Schweizer & West Mfg. Co., 310 N. Ada.	352

INTERLOCKING RUBBER TILE.

N. Y. Belting & Packing Co., 124 W. Lake	222
--	-----

IRON CASEMENT ADJUSTERS.

Wilkins, George Lester, 7067 N. Clark St.	272
---	-----

IRON DOORS AND SHUTTERS.

Angert Wire & Iron Wks., 6028 Grove Av.	254
Butler St. Fdry. & Iron Co., 3422 Normal	262
Central Arch'l Iron Wks., 3105 W. 27th	260
Cent'l Iron Wks. of Chgo., 939 W. Lake	262
Halsted, Joseph, Co., 1233 W. Randolph.	256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Hill, O. H. Co., 2253 St. Paul Av.	214
Holmes, Pyott & Co., 159 N. Jefferson.	258
Ill. Malleable Iron Co., 1801 Diversey.	318
Kinnear Mfg. Co., 208 S. La Salle St.	270
Saino Fire Door & Shutter Co., 2025 Elston	270
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
South Halsted St. Iron Wks., 2607 S. Halsted St.	258
Variety Mfg. Co., 2958 Carroll Ave.	270
Vierling Steel Wks., 23rd & Stewart	268

IRON FOUNDRIES.

Butler St. Fdry. & Iron Co., 3422 Normal	262
Ill. Malleable Iron Co., 1801 Diversey	318
Reder Fdry. Co., 2125 Canalport Av.	266

IRON RAILINGS AND FENCES.

Angert Wire & Iron Wks., 6028 Grove Av.	254
Bolter's A., Sons, Ward St. & Belden Av.	252
Butler St. Fdry. & Iron Co., 3422 Normal	262
Central Arch'l Iron Wks., 3105 W. 27th	260
Cent'l Iron Wks. of Chgo., 939 W. Lake	262
Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Chgo. Ornamental Iron Co., 37 & Stewart	260
Columbia Wire & Iron Wks., 1929 W. Lake	260
Duffin Iron Co., 4001 Wentworth Av.	268
Federal Iron Wks., 30 N. La Salle St.	254
Guaranty Iron & Wire Co., 2847 W. Lake	268
Halsted, Joseph, Co., 1233 W. Randolph.	256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Heath-Johnson Co., 306 W. Ontario	266
Holmes, Pyott & Co., 159 N. Jefferson.	258
Reder Fdry. Co., 2125 Canalport Av.	266
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
South Halsted St. Iron Wks., 2607 S. Halsted St.	258
Standard Tyler Co., 2420 W. 15th St.	266
Sullivan-Korber Co., 2137 W. 21st Pl.	266
Union Fdry Wks., 38 S. Dearborn St.	256
Vierling Steel Wks., 23rd & Stewart	268
Winslow Bros. Co., 4600 W. Harrison St.	262
Woodbridge Ornamental Iron Co., 400 W. Erie	262

IRON STAIRS.

American Bridge Co., 208 S. La Salle St.	252
Angert Wire & Iron Wks., 6028 Grove Av.	254
Butler St. Fdry. & Iron Co., 3422 Normal	262
Central Arch'l Iron Wks., 3105 W. 27th	260
Cent'l Iron Wks. of Chgo., 939 W. Lake	262
Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Chgo. Ornamental Iron Co., 37 & Stewart	260
Columbia Wire & Iron Wks., 1929 W. Lake	260
Duffin Iron Co., 4001 Wentworth Av.	268
Federal Iron Wks., 30 N. La Salle St.	254
Guaranty Iron & Wire Co., 2847 W. Lake	268
Halsted, Joseph, Co., 1233 W. Randolph.	256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Heath-Johnson Co., 306 W. Ontario	266
Holmes, Pyott & Co., 159 N. Jefferson.	258
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
South Halsted St. Iron Wks., 2607 S. Halsted St.	258
Standard Tyler Co., 2420 W. 15th St.	266
Sullivan-Korber Co., 2137 W. 21st Pl.	266
Union Fdry Wks., 38 S. Dearborn St.	256
Vierling Steel Wks., 23rd & Stewart	268
Winslow Bros. Co., 4600 W. Harrison St.	262
Woodbridge Ornamental Iron Co., 400 W. Erie	262

IRON ROOFS.

American Bridge Co., 208 S. La Salle St.	252
Jennet Bridge & Iron Wks., 3511 Shields.	238
Kenwood Bridge Co., 1st Nat. Bk. Bldg.	256
Morava Constr. Co., 122 S. Michigan.	256

IRON STORE FRONTS.

Angert Wire & Iron Wks., 6028 Grove Av.	254
Braun, J. G., 609 S. Paulina St.	272
Butler St. Fdry. & Iron Co., 3422 Normal	262
Central Arch'l Iron Wks., 3105 W. 27th	260
Cent'l Iron Wks. of Chgo., 939 W. Lake	262
Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Chgo. Ornamental Iron Co., 37 & Stewart	240
Columbia Wire & Iron Wks., 1929 W. Lake	260
Duffin Iron Co., 4001 Wentworth Av.	268
Federal Iron Wks., 30 N. La Salle St.	251
Halsted, Joseph, Co., 1233 W. Randolph.	256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Heath-Johnson Co., 306 W. Ontario	266
Holmes, Pyott & Co., 159 N. Jefferson.	258
Reeder Fdry. Co., 2125 Canalport Av.	266
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
South Halsted St. Iron Wks., 2607 S. Halsted St.	258
Standard Tyler Co., 2420 W. 15th St.	266
Sullivan-Korber Co., 2437 W. 21st Pl.	266
Union Fdry Wks., 38 S. Dearborn St.	256
Vierling Steel Wks., 23rd & Stewart	268
Winslow Bros. Co., 4600 W. Harrison St.	262
Woodbridge Ornamental Iron Co. 400 W. Erie	262

IRON WORK—ORNAMENTAL.

Angert Wire & Iron Wks., 6028 Grove Av.	254
Bolter's A. Sons, Ward St. & Belden Av.	252
Butler St. Fdry. & Iron Co., 3422 Normal	262
Central Arch'l Iron Wks., 3105 W. 27th	260
Cent'l Iron Wks. of Chgo., 939 W. Lake	262
Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Chgo. Ornamental Iron Co., 37 & Stewart	260
Chgo. Ventilator & Iron Wks., 838 W. Austin Av.	332
Columbia Wire & Iron Wks., 1929 W. Lake	260
Duffin Iron Co., 4001 Wentworth Av.	268
Federal Iron Wks., 30 N. La Salle St.	254
Halsted, Joseph, Co., 1233 W. Randolph.	256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Heath-Johnson Co., 306 W. Ontario	266
Holmes, Pyott & Co., 159 N. Jefferson.	258
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
South Halsted St. Iron Wks., 2607 S. Halsted St.	258
Standard Tyler Co., 2420 W. 15th St.	266
Sullivan-Korber Co., 2437 W. 21st Pl.	266
Union Fdry Wks., 38 S. Dearborn St.	256
Vierling Steel Wks., 23rd & Stewart	268
Winslow Bros. Co., 4600 W. Harrison St.	262
Woodbridge Ornamental Iron Co. 400 W. Erie	262

IRON WORK—STRUCTURAL.

Bolter's A. Sons, Ward St. & Belden Av.	252
Duffin Iron Co., 4001 Wentworth Av.	268
Federal Iron Wks., 30 N. La Salle St.	254
Holmes, Pyott & Co., 159 N. Jefferson.	258
Jennet Bridge & Iron Wks., 3541 Shields.	238
Kenwood Bridge Co., 1st Nat. Bk. Bldg.	256
Morava Constr. Co., 122 S. Michigan.	256
South Halsted St. Iron Wks., 2607 S. Halsted St.	258
Union Fdry. Wks., 38 S. Dearborn St.	256
Vierling Steel Wks., 23rd & Stewart	268

IRONING MACHINES (ELECTRIC)

Chgo. Dryer Co., 630 S. Wabash Av.	212
Commonwealth Edison Co., 72 W. Adams	208

JAIL AND PRISON BUILDERS.

Bolter's A. Sons, Ward St. & Belden Av.	252
Butler St. Fdry. & Iron Co., 3422 Normal	262
Halsted, Joseph, Co., 1233 W. Randolph.	256
Holmes, Pyott & Co., 159 N. Jefferson.	258
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
South Halsted St. Iron Wks., 2607 S. Halsted St.	258
Union Fdry Wks., 38 S. Dearborn St.	256
Vierling Steel Wks., 23rd & Stewart	268

KALSMINE.

Adams & Elting Co., 716 Washington Bl.	324
Moore, Benjamin & Co., 415 N. Green.	324
Wadsworth Howland Co., 225 N. Carpenter	324

LAMPS, EXTERIOR—IRON AND BRONZE.

Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Chgo. Ornamental Iron Co., 37 & Stewart	260
Halsted, Joseph, Co., 1233 W. Randolph.	256
Heath-Johnson Co., 306 W. Ontario	266
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
Standard Tyler Co., 2420 W. 15th St.	266
Sullivan-Korber Co., 2437 W. 21st Pl.	266
Warren, Walter G. & Co., 1401 W. Jackson	210
Williamson, R. & Co., 609 W. Wash.	210
Winslow Bros. Co., 4600 W. Harrison St.	262
Woodbridge Ornamental Iron Co. 400 W. Erie	262

LAMPS—ORNAMENTAL, ART GLASS.

Pick, Albert & Co., 1200 W. 35th St.	226
--------------------------------------	-----

LANDSCAPE ENGINEERS

Wittbold, Geo. Co., 737 Buckingham	222
------------------------------------	-----

LANTERNS.

Warren, Walter G. & Co., 1401 W. Jackson	210
Williamson, R. & Co., 609 W. Wash.	210

LATH—METAL AND WIRE.

Northwestern Expanded Metal Co., 407 S. Dearborn St.	18
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
Voss, Frederick, 1852 Austin Av.	222

LAUNDRY DRYERS.

Chgo. Dryer Co., 630 S. Wabash Av.	212
Troy Laundry Mch'y. Co., 23rd & La Salle	212

LAUNDRY MACHINERY.

Chgo. Dryer Co., 630 S. Wabash Av.	212
Troy Laundry Mch'y. Co., 23rd & La Salle	212

LAUNDRY TRAYS AND KITCHEN SINKS

Alberene Stone Co., 214 N. Clinton St.	246
--	-----

LEAD BURNING.

Gustafson, K. A., 2110 N. Springfield Av.	298
Hayward, R. B. Co., 406 W. Erie St.	304
Mellish-Hayward Co., 213 W. Austin Av.	298

LEATHER BELTING.

Allen, W. D. Mfg. Co., 133 W. Lake St.	222
--	-----

LIABILITY INSURANCE.

Builders & Mfrs. Mutual Casualty Co., 133 W. Washington St.	36
Chgo. Bonding & Surety Co., 29 S. La Salle	12
Mass. Bonding & Ins. Co., 175 W. Jackson.	220
National Surety Co., 209 S. La Salle St.	220
Sherman & Ellis, Inc., 29 S. La Salle St.	4

LIGHTING FIXTURES.

Everson, C. G. & Co., 70 W. Lake St.	210
Johns-Manville, H. W. Co., 18th & Mich.	330
Warren, Walter G. & Co., 1401 W. Jackson	210
Williamson, R. & Co., 609 W. Wash. St.	210

LIGHTNING RODS

Arrow Conductor & Mfg. Co., 1536 W. Adams	78
---	----

LIME.

Rosing, Astrid S., 111 W. Monroe St.	242
--------------------------------------	-----

LOANS.

Baird & Warner, 29 S. La Salle St.	220
Corn Exc. Nat'l Bank, 134 S. La Salle	36
Greenbaum Sons Bank & Trust Co., 9 S. La Salle St.	220

LOCKERS—SHEET STEEL.

Dodge, H. B. & Co., 332 S. Michigan Av.	214
Federal Steel Fixture Co., 189 W. Madison	272

LOCKERS—VENTILATED.

Dodge, H. B. & Co., 332 S. Michigan Av.	214
Federal Steel Fixture Co., 189 W. Madison	272
Smith, F. P. W. & I. Wks., 56 W. Lake.	258

LUMBER.

Burns, J. E. Lumber Co., 700 W. Chicago	350
Hines, Edw. Lumber Co., 2431 S. Lincoln	24
Rittenhouse & Embree Co., 3500 S. Racine.	348
Schillo, Adam, Lumber Co., Kingsbury & Blackhawk Sts.	350
Thornton-Claney Lumber Co., 2315 Elston	26
Wilce, T. Co., The, 2209 S. Throop St.	348

LUMBER—KILN DRIED.

Burns, J. E. Lumber Co., 700 W. Chicago	350
Hines, Edw. Lumber Co., 2431 S. Lincoln	24
Rittenhouse & Embree Co., 3500 S. Racine.	348
Schillo, Adam, Lumber Co., Kingsbury & Blackhawk Sts.	350
Thornton-Claney Lumber Co., 2315 Elston	26
Wilce, T. Co., The, 2209 S. Throop St.	348

LUMBER—YELLOW PINE—LONG LEAF.

Burns, J. E. Lumber Co., 700 W. Chicago	350
Hines, Edw. Lumber Co., 2431 S. Lincoln	24
Rittenhouse & Embree Co., 3590 S. Racine	348
Schillo, Adam. Lumber Co., Kingsbury & Blackhawk Sts.	350
Thornton-Claney Lumber Co., 2315 Elston	26
Wilce, T. Co., The, 2209 S. Throop St.	348

MACHINISTS.

Gallaher & Speck, 215 W. Congress St.	302
Kaestner & Hecht Co., 500 S. Throop St.	264
Weller Mfg. Co., 1820 N. Kostner Av.	336

MAGNESIA PRODUCTS.

Cent'l Asbestos & Magnesia Co., 214 W. Grand Av.	330
Krehs-Manville, H. W. Co., 18th & Mich.	330
John, Paul J., Co., 444 N. La Salle St.	330
Watson, H. F. Co., 319 Wells St.	330

MANHOLE COVERS.

Dee, Wm. E. Co., 30 N. La Salle St.	242
-------------------------------------	-----

MANTELS.

Colonial Fire Place Co., 4611 W. 12th.	38
Interior Tiling Co., 21 E. Van Buren St.	248

MARBLE CONTRACTORS.

Alabama Marble Co., 80 E. Jackson Bl.	80
Art Marble Co., 2608 Flournoy St.	248
Davis Marble Co., 1450 W. North Ave.	248
Flavin Marble Mill, 3542 Shields Av.	250
Marthens, Chester N., Marble Co., 53rd & Wallace Sts.	248

MARBLE—INTERIOR & EXTERIOR.

Alabama Marble Co., 80 E. Jackson Bl.	80
Flavin Marble Mill, 3542 Shields Av.	232
Marthens, Chester N., Marble Co., 53rd & Wallace Sts.	248

MARBLE WORKERS AND DEALERS.

Alabama Marble Co., 80 E. Jackson Bl.	80
Art Marble Co., 2608 Flournoy St.	248
Colonial Fire Place Co., 4611 W. 12th.	38
Davis Marble Co., 1450 W. North Ave.	248
Flavin Marble Mill, 3542 Shields Av.	250
Marthens, Chester N., Marble Co., 53rd & Wallace Sts.	248

MASON CONTRACTORS.

Anderson, A. & E. Co., 19 S. La Salle St.	48
Anderson-Stevens Co., 30 N. La Salle St.	52
Appel, Henry L. Co., 179 W. Wash.	54
Balkin Constr. Co., 53 W. Jackson Bl.	54
Barnard, H. B., 140 S. Dearborn St.	52
Bulley & Andrews, 25 N. Dearborn St.	72
Burke, Frank, 35 S. Dearborn St.	74
B. W. Constr. Co., 10 S. La Salle Street	58
Cadenhead Co., 30 N. La Salle St.	50
Carter, W. G. Co., 133 W. Washington St.	58
Casey Constr. Co., 8 S. Dearborn St.	70
Chaney-Archibald Co., 189 W. Madison St.	74
Clark, C. Everett Co., 69 W. Wash. St.	46
Doherty, Frank E., 133 W. Washington	58
Dowling & Rutherford, 54 W. Randolph	62
Dunning, W. N. Constr. Co., 10 S. La Salle	76
Eriesson, Henry Co., 139 N. Clark St.	214
Fuller, Geo. A. Co., Marquette Bldg.	44
Gindele, Chas. W. Co., 3333 La Salle St.	70
Griffiths, John & Son Co., 112 W. Adams	42
Hanson Bros. Co., 127 N. Dearborn St.	62
Jeffrey, John, Co., 127 N. Dearborn St.	70
Jensen & Steenhil, 105 S. Dearborn St.	62
Johnson, Chas. B. & Sons, 111 W. Wash.	74
Jones Constr. Co., 1748 W. Madison St.	72
Kalchbrenner, J., 133 W. Washington St.	64
Kirkland Constr. Co., 133 W. Wash. St.	64
Krahl Construction Co., 62 W. Madison	54
Lanquist & Hilsley Co., 1100 N. Clark St.	46
Ledgerwood, A. J. C., 337 W. Madison	48
Leonard Constr. Co., 332 S. Michigan	42
Lindell, Gust., 1325 Granville Av.	76
Lynch, Austin J. Co., 111 W. Monroe St.	52
Martin Constr. Co., 82 W. Washington	64
Mayer, Wm., Co., 72 W. Adams St.	44
McLennan Constr. Co., 30 N. Michigan Av.	50
Menke-Thielberg Co., 139 N. Clark St.	48
Meyne, Gerhardt F., 127 N. Dearborn St.	66
Moreland, H. D. Co., 723 Reaper Bldg.	58
Moses, C. A. Constr. Co., 133 W. Wash.	56
Mutual Constr. Co., 155 N. Clark St.	68
Naylor, Thomas, Co., 111 W. Washington	64
Nicholson-Zimmerman Co., 133 W. Wash.	50
Olson, J. E., 111 W. Washington St.	68
Olson, Peter, Co., 19 S. La Salle St.	60

Paschen Bros., 111 W. Washington St.	56
Regnell, B. J., Co., 19 S. La Salle St.	66
Rodatz, Jacob, The Rookery.	62
Rosenthal, O. W., & Co., 80 E. Jackson.	72
Rauen, Math., 111 W. Washington St.	60
Salomon-Waterton Co., 343 S. Dearborn	60
Samuelson, A. J., 189 W. Madison St.	76
Scharmer Constr. Co., 139 N. Clark St.	60
Schmidt Bros. Constr. Co., 105 N. Clark.	56
Shedden, James & Co., 106 N. La Salle.	46
Simmons, J. L. Co., 1239 W. Madison St.	50
Snyder, J. W. Co., 122 S. Michigan Av.	44
Sollitt, Ralph & Sons, Constr. Co., 140 S. Dearborn St.	54
Sollitt, Sumner, Co., 79 E. Adams St.	46
Spiering, Ed., 105 N. Clark St.	72
Stewart, James & Co., 110 S. Dearborn.	42
Stiles, Geo. W. Constr. Co., Rookery.	66
Strandberg, E. P. Co., 5010 S. Wabash	56
Thompson-Starrett Co., 175 W. Jackson	44
Thomson, Geo. & Son Co., 30 N. La Salle St.	68
Todd, James & Co., 19 S. La Salle St.	66
Waldman Constr. Co., 154 W. Randolph St.	76
Wells Bros. Co., 53 W. Jackson Bl.	42
Wilson, R. F. & Co., 154 W. Randolph	48

MATERIAL HOISTS.

Sasgen Derrick Co., Grand & Albany Aves.	336
Thomas Elevator Co., 20 S. Hoyne Av.	336

METAL CEILING.

Knisely Bros., 28th Pl. & 5th Av.	274
Staer, Frank, 1473 N. Halsted St.	274

METAL LATH.

Northwestern Expanded Metal Co., 407 S. Dearborn St.	18
Trussed Concrete Steel Co., 122 S. Mich.	234
Voss, Frederick, 1852 Austin Av.	222

METAL SASH & FRAMES.

Am. Steel Window Co., 332 S. Michigan	272
Knisely Bros., 28th Pl. & 5th Av.	274
Lupton, David, Sons Co., 175 W. Jackson	38
McFarland & Hyde Co., 2701 S. 5th Av.	8
Staer, Frank, 1473 N. Halsted St.	274
Trussed Concrete Steel Co., 122 S. Mich.	234

METALLIC DOORS AND TRIM.

Art Metal Fire-Proof Door & Trim Co., 2734 Wentworth Ave.	274
Hill, O. H. Co., 2253 St. Paul Av.	214
Knisely Bros., 28th Pl. & 5th Av.	274
Nat. Automatic Door Co., 175 W. Jack.	16
Saino Fire Door & Shutter Co., 2025 Elston Av.	270
Variety Mfg. Co., 2958 Carroll Av.	270

MILL WORK.

Anderson & Lind Mfg. Co., 2127 Iowa St.	352
Curtis Door & Sash Co., 1414 S. Western	18
Morgan Sash & Door Co., 2287 Blue Island Av.	Inside Back Cover.
Nollau & Wolff Mfg. Co., 1705 Fullerton	352

MINERAL WOOL.

Cent'l Asbestos & Magnesia Co., 214 W. Grand Av.	330
Krez, Paul J., Co., 111 N. La Salle St.	330
Union Insulating Co., 20 W. Jackson Blvd	328
Watson, H. F. Co., 319 Wells St.	330

MORTGAGE LOANS.

Baird & Warner, 29 S. La Salle St.	220
Corn Exe. Nat'l Bank, 131 S. La Salle	36
Greenbaum Sons Bank & Trust Co., 9 S. La Salle St.	220

MOSAICS.

Art Marble Co., 2608 Flournoy St.	248
Davis Marble Co., 1150 W. North Ave.	248
Flavin Marble Mill, 3542 Shields Av.	250
Interior Tiling Co., 21 E. Van Buren St.	248
Marthens, Chester N., Marble Co., 53rd & Wallace Sts.	248
Mosaic Tile Co., 101 S. Michigan Av.	250

MOSAICS—CERAMICS, ETC.

Art Marble Co., 2608 Flournoy St.	248
Davis Marble Co., 1150 W. North Ave.	248
Flavin Marble Mill, 3542 Shields Av.	250
Interior Tiling Co., 21 E. Van Buren St.	248
Marthens, Chester N., Marble Co., 53rd & Wallace Sts.	248
Mosaic Tile Co., 101 S. Michigan Av.	250

MOULDINGS.

Anderson & Lind Mfg. Co., 2127 Iowa St. 352
 Curtis Door & Sash Co., 1414 S. Western 18
 Morgan Sash & Door Co., 2287 Blue
 Island Av. Inside Back Cover.
 Nollan & Wolff Mfg. Co., 1705 Pullerton. 352

**MOULDINGS—BRASS, BRONZE, COLD
 DRAWN STEEL, COPPER, GERMAN
 SILVER—ALL METAL SPECIAL
 SHAPES.**

Brasco Mfg. Co., 1455 S. Michigan Av. 6
 Braun, J. G., 609 S. Paulina St. 272
 Kawneer Mfg. Co., 11 S. La Salle St. 4
 Zouri Drawn Metals Co., 38 S. Dearborn St. 1

MURAL DECORATIONS.

Spielring & Linden, 1216 Michigan Av. 326

NOSINGS—PATENTED STAIR.

Braun, J. G., 609 S. Paulina St. 272

NURSERY MEN.

Wittbold, Geo. Co., 737 Buckingham 222

OFFICE BUILDING DIRECTORIES.

Tablet & Ticket Co. (Willsons) 621 W.
 Adams St. 226

OFFICE FITTINGS AND FURNITURE.

Schweizer & West Mfg. Co., 310 N. Ada. 352

OFFICE FIXTURES.

Schweizer & West Mfg. Co., 310 N. Ada. 352
 Brunswick-Balke-Collender Co., 623 S.
 Wabash Av. 6

OFFICE FIXTURE STEEL.

Federal Steel Fixture Co., 189 W. Madison 272

**ORNAMENTAL IRON BANK AND OF-
 FICE FIXTURES.**

Cent'l Iron Wks. of Chgo., 939 W. Lake 262
 Chgo. Architectural Bronze Co., 519 W.
 Van Buren St. 260
 Chgo. Ornamental Iron Co., 37 & Stewart 260
 Columbia Wire & Iron Wks., 1929 W. Lake 260
 Halsted, Joseph, Co., 1233 W. Randolph. 256
 Hauke Iron & Wire Wks., N. Albany &
 W. Chgo. Aves. 258
 Heath-Johnson Co., 306 W. Ontario. 268
 Smith, F. P. W. & L. Wks., 56 W. Lake. 258
 Standard Tyler Co., 2429 W. 15th St. 266
 Sullivan-Korber Co., 2437 W. 21st Pl. 266
 Union Edry Wks., 38 S. Dearborn St. 256
 Winslow Bros. Co., 4600 W. Harrison St. 262
 Woodbridge Ornamental Iron Co., 400 W. Erie 262

**ORNAMENTAL PATTERNS FOR METAL
 CASTINGS.**

Dux, Joseph, 2112 W. Van Buren St. 346

ORNAMENTAL TERRA COTTA.

Advance Terra Cotta Co., 29 S. La Salle 246
 Am. Terra Cotta & Ceramic Co., 122 S. Mich. 246
 Midland Terra Cotta Co., 11 S. La Salle. 40
 Northwestern Terra Cotta Co., 2525 Clyb'rn 10

PACKAGE CONVEYORS.

Alvey Mfg. Co., 227 S. La Salle St. 274
 Webster Engineering Co., 30 N. La Salle 336
 Weller Mfg. Co., 1820 N. Kostner Av. 336

PACKING.

Jenkins Bros., 309 W. Lake St. 282

PAINTS.

Adams & Elting Co., 716 Washington Bl. 324
 Lucas, John & Co., 1362 W. 37th St. 324
 Moore, Benjamin & Co., 415 N. Green. 324
 Wadsworth Howland Co., 225 N. Carpenter 324

PAINT—CEMENT.

de Smet, Geo. W., 133 W. Washington 236
 Garden City Sand Co., 133 W. Wash. 242
 Moore, Benjamin & Co., 415 N. Green. 324
 Union Insulating Co., 20 W. Jackson Blvd 328
 Wadsworth Howland Co., 225 N. Carpenter 324

PAINT—COLD WATER.

Adams & Elting Co., 716 Washington Bl. 324
 Lucas, John & Co., 1362 W. 37th St. 324
 Moore, Benjamin & Co., 415 N. Green. 324
 Wadsworth Howland Co., 225 N. Carpenter 324

PAINT—FIREPROOF.

Adams & Elting Co., 716 Washington Bl. 324
 Imperial Water Proof Co., 105 W. Monroe 230
 Johns-Manville, H. W. Co., 18th & Mich. 330
 Moore, Benjamin & Co., 415 N. Green. 324
 Wadsworth Howland Co., 225 N. Carpenter 324

PAINT—DAMP RESISTING.

Barrett Mfg. Co., 10 S. La Salle St. 22
 Ceresit Waterproofing Co., 110 S. Dear. 230
 de Smet, Geo. W., 133 W. Washington 236
 Garden City Sand Co., 133 W. Wash. 242
 Imperial Water Proof Co., 105 W. Monroe 230
 Scofield, Evans & Co., 24 E. 8th St. 234
 Union Insulating Co., 20 W. Jackson Blvd 328

PAINT—GRAPHITE.

Adams & Elting Co., 716 Washington Bl. 324
 Lucas, John & Co., 1362 W. 37th St. 324
 Moore, Benjamin & Co., 415 N. Green. 324
 Union Insulating Co., 20 W. Jackson Blvd 328
 Wadsworth Howland Co., 225 N. Carpenter 324

PAINT—IRON.

Adams & Elting Co., 716 Washington Bl. 324
 Barrett Mfg. Co., 10 S. La Salle St. 22
 Ceresit Waterproofing Co., 110 S. Dear. 230
 Garden City Sand Co., 133 W. Wash. 242
 Imperial Water Proof Co., 105 W. Monroe 230
 Lucas, John & Co., 1362 W. 37th St. 324
 Moore, Benjamin & Co., 415 N. Green. 324
 Scofield, Evans & Co., 24 E. 8th St. 234
 Union Insulating Co., 20 W. Jackson Blvd 328
 Wadsworth Howland Co., 225 N. Carpenter 324

PAINTS—MIXED.

Adams & Elting Co., 716 Washington Bl. 324
 Lucas, John & Co., 1362 W. 37th St. 324
 Moore, Benjamin & Co., 415 N. Green. 324
 Wadsworth Howland Co., 225 N. Carpenter 324

PAINTS—ROOFING.

Adams & Elting Co., 716 Washington Bl. 324
 Barrett Mfg. Co., 10 S. La Salle St. 22
 Bird & Son, 53 W. Jackson Bl. 328
 Cent'l Asbestos & Magnesia Co., 214 W.
 Grand Av. 330
 Garden City Sand Co., 133 W. Wash. 242
 Johns-Manville, H. W. Co., 18th & Mich. 330
 Krez, Paul J., Co., 444 N. La Salle St. 330
 Lucas, John & Co., 1362 W. 37th St. 324
 Moore, Benjamin & Co., 415 N. Green. 324
 Union Insulating Co., 20 W. Jackson Blvd 328
 Wadsworth Howland Co., 225 N. Carpenter 324
 Watson, H. F. Co., 319 Wells St. 330

PAINTING CONTRACTORS.

Gleich, T. C., 2860 Broadway. 326
 Noelle, J. B. Co., 702 Wells St. 326
 Spielring & Linden, 1216 Michigan Av. 326
 Sullivan, J. P., 4515 Indiana Av. 326

PAINT MILLS & MACHINERY.

Kaestner & Hecht Co., 500 S. Throop St. 264

PAINTERS' SUPPLIES.

Adams & Elting Co., 716 Washington Bl. 324
 Lucas, John & Co., 1362 W. 37th St. 324
 Wadsworth Howland Co., 225 N. Carpenter 324

PALMS—ARTIFICIAL.

Pick, Albert & Co., 1200 W. 35th St. 226

PARTITION TILE.

Dee, Wm. F. Co., 30 N. La Salle St. 242
 Johnson E. V., 80 E. Jackson Blvd. 238
 Nat'l Fire Proofing Co., 327 S. La Salle. 238
 Rosing, Astrid S., 111 W. Monroe St. 242
 Western Brick Co., Danville, Ill. 244

PHYSICAL LABORATORY.

Hunt, Robt. W. & Co., Ins. Exc. Bldg. 334

PIPE.

Nat. Tube Co., 208 S. La Salle St. & Pitts-
 burgh, Pa. 30

PIPE—STEEL.

Nat. Tube Co., 208 S. La Salle St. & Pitts-
 burgh, Pa. 30

PIPE AND BOILER COVERING.

Cent'l Asbestos & Magnesia Co., 214 W.
 Grand Av. 330
 Garden City Sand Co., 133 W. Wash. 242
 Johns-Manville, H. W. Co., 18th & Mich. 330
 Krez, Paul J., Co., 444 N. La Salle St. 330
 Watson, H. F. Co., 319 Wells St. 330

PILING.

Lake Superior Piling Co., 961 W. 22nd St. 78

PILING CONCRETE.

Raymond Concrete Pile Co., 111 W. Monroe 236

PILING DEALERS.

Lake Superior Piling Co., 961 W. 22nd St. 78

PILING MANUFACTURERS.

Lake Superior Piling Co., 961 W. 22nd St. 78

PILING—WOOD.

Lake Superior Piling Co., 961 W. 22nd St. 78

PLASTER.

Architectural Dec. Co., 1600 S. Jefferson 346
 Decorators Sup. Co., 2547 Archer Av. 338
 Tudor, J. T., 455 W. Chicago Av. 346
 U. S. Gypsum Co., 205 W. Monroe St. 20
 Zettler, A., 458 N. Sangamon St. 346

PLASTER BOARD.

Bird & Son, 53 W. Jackson Bl. 328
 U. S. Gypsum Co., 205 W. Monroe St. 20

PLASTER COVERING.

Nat'l Kellastone Co., 19 S. La Salle St. 238

PLASTER—ORNAMENTAL.

Architectural Dec. Co., 1600 S. Jefferson 346
 Decorators Sup. Co., 2547 Archer Av. 338
 Tudor, J. T., 455 W. Chicago Av. 346
 Zettler, A., 458 N. Sangamon St. 346

PLASTERING CONTRACTORS.

Balhatset, Wm. Co., 111 W. Washington 342
 Curran, Wm. J., 30 N. La Salle St. 344
 Dwyer, James J. Co., 19 S. La Salle St. 342
 Goss & Guise, 189 W. Madison St. 344
 Lennox-Haldeman Co., 208 S. La Salle St. 340
 McNulty Bros. Co., Railway Exc. Bldg. 340
 Middleton, Edw. Co., 133 W. Washington. 340
 Parent, N. J. Co., 3525 S. Hoyne Av. 344
 Stern Smith Co., The, 38 S. Dearborn St. 342
 Sutton Plastering Co., 110 S. Dearborn St. 342
 Williams, Wm., 19 S. La Salle St. 341
 Zander-Reum Co., 165 W. Monroe St. 340

PLASTERING MATERIAL.

Garden City Sand Co., 133 W. Wash. 242
 Hydraulic Sand & Transit Co., Otis Bldg. 242
 Rosing, Astrid S., 111 W. Monroe St. 242
 U. S. Gypsum Co., 205 W. Monroe St. 20

PLASTIC RELIEF.

Architectural Dec. Co., 1600 S. Jefferson 346
 Decorators Sup. Co., 2547 Archer Av. 338
 Tudor, J. T., 455 W. Chicago Av. 346
 Zettler, A., 458 N. Sangamon St. 346

PLUMBING SPECIALTIES.

Sloan Valve Co., 617 W. Jackson Blvd. 314

PLUMBING, GASFITTING AND SEWER-AGE.

Am. Heating & Plumbing Corp., 51 W. Rand 288
 Corboy, M. J. Co., 178 W. Randolph St. 308
 Daly, J. J., 408 Wells St. 296
 Dwyer & Co., 31 W. Illinois St. 300
 Farwell, B. J., 410 S. Sherman St. 308
 Hanley-Casey Mech. Equip. Co., 410 W. Ohio St. 306
 Henrich, Geo. A., 5650 Broadway. 306
 Murphy Plumbing Co., 23 E. Congress St. 308
 Nacey, P. Co., 927 S. State St. 292
 Nelson, R. J. Co., 836 W. Adams St. 308
 Nilson Bros., 3222 N. Halsted St. 288
 Nilson, G. Albin, 329 N. Clark St. 310
 Noble & Thumm, 2313 Lincoln Av. 310
 Peckham, Harry, Jr., 209 Milwaukee Av. 292
 Stein, Carl John, Co., 853 S. State St. 304

POWER EQUIPMENT.

Stannard Power Equip. Co., 53 W. Jack. 312

POWER PLANTS.

Am. Heating & Plumbing Corp., 51 W. Rand 288
 Caffey, E. J. Co., 12 W. Illinois St. 288
 Gallaher & Speck, 215 W. Congress St. 302
 Glennon-Bielke Co., 546 W. Lake St. 304
 Graves Heating Co., 162 N. Desplaines 292
 Hanley-Casey Mech. Equip. Co., 410 W. Ohio St. 306
 Henrich, Geo. A., 5650 Broadway. 306
 Johnson, C. W., Inc., 611 Wash. Blvd. 296
 Kirk, Geo. H., 6711 Wentworth Av. 296
 McDonough, E. J. Co., 19 W. Kinzie St. 302
 Prentice, L. H. Co., 328 Sherman St. 290

POWER PUMPS.

Am. Steam Pump Co., 53 W. Jackson 312
 Chgo. Pump Co., 905 W. Lake St. 14
 Yeomans Bros., 231 Institute Pl. 312

PREPARED ROOFING MATERIALS.

Amalgamated Roofing Co., 431 S. Dear. 224
 Barrett Mfg. Co., 10 S. La Salle St. 22
 Beckman-Dawson Co., 19 S. La Salle St. 328
 Bird & Son, 53 W. Jackson Bl. 328
 Cent'l Asbestos & Magnesia Co., 214 W. Grand Av. 330
 Krez, Paul J., Co., 144 N. La Salle St. 330
 Patent Vulcanite Rfg. Co., 2256 W. 49th 34
 Watson, H. P. Co., 319 Wells St. 330

PROVISION BOXES—SELF-LOCKING.

Union Welded Products Co., 524 W. Jackson 2

PUMPS.

Am. Steam Pump Co., 53 W. Jackson 312
 Chgo. Pump Co., 905 W. Lake St. 14
 Kroeschell Bros. Co., 440 W. Erie St. 290
 Yeomans Bros., 231 Institute Pl. 312

PUMPING MACHINERY

Am. Steam Pump Co., 53 W. Jackson 312
 Chgo. Pump Co., 905 W. Lake St. 14
 Kehm Bros. Co., 15 W. Kinzie St. 290
 Yeomans Bros., 231 Institute Pl. 312

PUMPS—AUTOMATIC AND HYDRAULIC.

Am. Steam Pump Co., 53 W. Jackson 312
 Chgo. Pump Co., 905 W. Lake St. 14
 Kehm Bros. Co., 15 W. Kinzie St. 290
 Yeomans Bros., 231 Institute Pl. 312

PUMPS—ELECTRIC.

Chgo. Pump Co., 905 W. Lake St. 14
 Yeomans Bros., 231 Institute Pl. 312

PUMPS—VACUUM.

Iroquois Eng. Co., 313 S. Dearborn 306

RADIATOR—PACKLESS VALVES.

Dole Valve Co., The, 208 N. 5th Av. 314

RADIATORS.

Arcade Steam Heating Co., 126 W. Kinzie 306
 Kewanee Boiler Co., 328 W. Washington 276-277
 & Kewanee, Ill. 276-277
 McDonough, E. J. Co., 19 W. Kinzie St. 302
 Prentice, L. H. Co., 328 Sherman St. 290
 Scott Valve Co., 310 W. Randolph St. 314
 Western Valve Co., 188 N. Market St. 314

RADIATOR SHIELDS.

Hayward, R. B. Co., 406 W. Erie St. 304
 McDonough, E. J. Co., 19 W. Kinzie St. 302
 Mellish-Hayward Co., 213 W. Austin Av. 298
 Prentice, L. H. Co., 328 Sherman St. 290

REAL ESTATE LOANS.

Baird & Warner, 29 S. La Salle St. 220
 Corn Exe. Nat'l Bank, 131 S. La Salle 36
 Greenebaum Sons Bank & Trust Co., 9 S. La Salle St. 220

RECEPTICALS—PARCEL AND PRO-VISION BUILT IN.

Union Welded Products Co., 524 W. Jackson 2

REFRIGERATING & ICE MAKING**MACHINERY.**

Kroeschell Bros. Co., 410 W. Erie St. 290

REFRIGERATORS.

Brunswick Balke-Collender Co., 623 S. Wabash Av. 6

McCray Refrigerator Co., 1000 S. Mich. Av. & Kendallville, Ind. 12

Orr & Lockett, Hdw. Co., 14 W. Randolph 212

Pick, Albert & Co., 1200 W. 35th St. 226

REFLECTORS—DIRECT & INDIRECT.

Nat'l X-Ray Reflectors Co., 235 Jackson. 206

REINFORCED CONCRETE CONSTRUCTION.

Chaney-Archibald Co., 189 W. Madison St. 74
 Dunning, W. N. Constr. Co., 19 S. La Salle 76
 Jensen & Steinhilf, 105 S. Dearborn St. 62
 Kirkland Const. Co., 133 W. Washington 64
 Menke-Thielberg Co., 139 N. Clark St. 48
 Meyne, Gerhardt E., 127 N. Dearborn St. 66
 Wilson, R. E. & Co., 154 W. Randolph 48

REINFORCING BARS—CONCRETE.

Concrete Steel Co., 53 W. Jackson Blvd. 264
 Trussed Concrete Steel Co., 122 S. Mich. 234

REINFORCING STEEL FABRIC.
Northwestern Expanded Metal Co., 407 S. Dearborn St. 18

REMODELING AND REPAIR WORK
Jones Constr. Co., 1718 W. Madison St. 72
Aloyno, Gerhardt F., 127 N. Dearborn St. 66
Mutual Constr. Co., 155 N. Clark St. 68
Schmidt Bros. Constr. Co., 105 N. Clark. 56

REGULATORS—DAMPER.
Davis, G. M., Regulator Co., 422 Milw'kee 298

REGULATORS—HEAT—STEAM—AIR—WATER.
Annex Co., 175 W. Jackson Blvd. and Knoxville, Tenn. 310
Davis, G. M., Regulator Co., 422 Milw'kee 298
Johnson Service Co., 177 N. Dearborn. 294
Nat'l Regulator Co., 298 S. Jefferson. 291
Powers Regulator Co., 5 S. Wabash Av. 291

ROLLER SPIRALS.
Alvey Mfg. Co., 327 S. La Salle St. 271

ROLLING PARTITIONS—WOOD AND STEEL.
Dodge, H. B. & Co., 332 S. Michigan Av. 211

ROOF TRUSSES.
McKeown Bros., 1817 Cottage Grove Av. 71

ROOFING.
Advance Roofing & Sheet Metal Wks., 1830 Cottage Grove Ave. 274
Atlas Roofing Co., 1735 W. Madison St. 224
Barrett Mfg. Co., 19 S. La Salle St. 22
Patent Vulcanite Roofing Co., 2256 W. 49. 34
Renand, F. D., 545 W. 31st St. 224
Standard Roofing Co., 1615 W. Lake St. 224
Watson, H. F. Co., 319 Wells St. 330

ROOFING—ASBESTOS.
Amalgamated Roofing Co., 431 S. Dear. 224
Bird & Son, 53 W. Jackson Bl. 328
Cent'l Asbestos & Magnesia Co., 214 W. Grand Av. 330
Johns-Manville, H. W. Co., 18th & Mich. 330
Patent Vulcanite Roofing Co., 2256 W. 49th 34
Watson, H. F. Co., 319 Wells St. 330

ROOFING—CORRUGATED IRON.
Advance Roofing & Sheet Metal Wks., 4830 Cottage Grove Ave. 274
Kniskely Bros., 28th Pl. & 5th Av. 274
McFarland & Hyde Co., 2701 S. 5th Av. 8
Staar, Frank, 1473 N. Halsted St. 274

ROOFING—GENERAL.
Atlas Roofing Co., 1735 W. Madison St. 224
Standard Roofing Co., 1615 W. Lake St. 224

ROOFING—GRAVEL.
Advance Roofing & Sheet Metal Wks., 4830 Cottage Grove Ave. 274
Atlas Roofing Co., 1735 W. Madison St. 224
Barrett Mfg. Co., 19 S. La Salle St. 22
Renand, F. D., 545 W. 31st St. 224
Standard Roofing Co., 1615 W. Lake St. 224

ROOFING TILE.
U. S. Gypsum Co., 205 W. Monroe St. 20

ROOFING AND SIDING MATERIAL.
Beckman-Dawson Co., 19 S. La Salle St. 328
Bird & Son, 53 W. Jackson Bl. 328

ROOFING PAINTS.
Barrett Mfg. Co., 19 S. La Salle St. 22
Beckman-Dawson Co., 19 S. La Salle St. 328
Bird & Son, 53 W. Jackson Bl. 328
Johns-Manville, H. W. Co., 18th & Mich. 330
Moore, Benjamin & Co., 415 N. Green. 321
Watson, H. F. Co., 319 Wells St. 330

ROOFING TIN.
Am. Sheet & Tin Plate Co., 208 S. La Salle St. and Pittsburgh, Pa. 28

ROOFING—MATERIALS.
Atlas Roofing Co., 1735 W. Madison St. 224
Barrett Mfg. Co., 19 S. La Salle St. 22
Beckman-Dawson Co., 19 S. La Salle St. 328
Bird & Son, 53 W. Jackson Bl. 328
Garden City Sand Co., 133 W. Wash. 242
Johns-Manville, H. W. Co., 18th & Mich. 330
Patent Vulcanite Roofing Co., 2256 W. 49. 34
Standard Roofing Co., 1615 W. Lake St. 224
Watson, H. F. Co., 319 Wells St. 330

ROOFING—TIN, SLATE, TILE AND METAL.
Advance Roofing & Sheet Metal Wks., 4830 Cottage Grove Ave. 274
Kniskely Bros., 28th Pl. & 5th Av. 274
Staar, Frank, 1473 N. Halsted St. 274

ROOFING PAPER.
Barrett Mfg. Co., 19 S. La Salle St. 22
Beckman-Dawson Co., 19 S. La Salle St. 328
Bird & Son, 53 W. Jackson Bl. 328
Cent'l Asbestos & Magnesia Co., 214 W. Grand Av. 330
Krez, Paul J., Co., 441 N. La Salle St. 330
Patent Vulcanite Roofing Co., 2256 W. 49. 34
Watson, H. F. Co., 319 Wells St. 330

ROPE TRANSMISSION MACHINERY.
Kaestner & Hecht Co., 500 S. Throop St. 264
Weller Mfg. Co., 1820 N. Kostner Av. 336

RUBBER TILE.
N. Y. Belting & Packing Co., 124 W. Lake 222

RUBBER BELTING.
Allen, W. D. Mfg. Co., 133 W. Lake St. 222

RUBBER HOSE.
Allen, W. D. Mfg. Co., 133 W. Lake St. 222

RUBBER TILING—FLOORS FOR ELEVATORS AND PUBLIC PLACES.
N. Y. Belting & Packing Co., 124 W. Lake 222

RUGS AND CARPETS—ORIENTAL AND DOMESTIC.
Pick, Albert & Co., 1200 W. 35th St. 226

SAFETY SETTING PLATE GLASS.
Brasco Mfg. Co., 1455 S. Michigan Av. 6
Kawneer Mfg. Co., 11 S. La Salle St. 4
Zouri Drawn Metals Co., 38 S. Dearborn St. 1

SAND AND GRAVEL.
Brownell Improvement Co., 133 W. Wash. 236
Dee, Wm. E. Co., 30 N. La Salle St. 242
Garden City Sand Co., 133 W. Wash. 242
Hydraulic Sand & Transit Co., Otis Bldg. 242
Rosing, Astrid S., 111 W. Monroe St. 242

SAND AND GRAVEL HANDLING MACHINERY.
Sasgen Derrick Co., Grand & Albany Aves. 336
Thomas Elevator Co., 20 S. Hoyne Av. 336
Webster Engineering Co., 30 N. La Salle 336

SASH, DOORS AND BLINDS.
Anderson & Lind Mfg. Co., 2127 Iowa St. 352
Curtis Door & Sash Co., 1414 S. Western 18
Morgan Sash & Door Co., 2287 Blue Island Av. Inside Back Cover.
Nollau & Wolff Mfg. Co., 1705 Fullerton. 352

SASH—SAWTOOTH CONSTRUCTION
Lupton, David, Sons Co., 175 W. Jackson 38

SASH—STEEL
Am. Steel Window Co., 332 S. Michigan 272
Lupton, David, Sons Co., 175 W. Jackson 38
Trussed Concrete Steel Co., 122 S. Mich. 234

SCALES.
Pick, Albert & Co., 1200 W. 35th St. 226

SCALE MODELS OF BUILDINGS.
Architectural Dec. Co., 1600 S. Jefferson 346
Dux, Joseph, 2112 W. Van Buren St. 346
Tudor, J. T., 455 W. Chicago Av. 346
Zettler, A., 458 N. Sangamon St. 346

SCREENS—WINDOW AND DOOR.
Burrows, E. T. Co., 140 S. Dearborn St. 16
Chamberlin Metal Weather Strip Co., 626 S. Dearborn St. 230
Robbins Mfg. Co., 53 W. Jackson Blvd. 230
Van Dame, W. L., 58 E. Washington St. 2

SEATS—CLOSET.
Brunswick-Balke-Clender Co., 623 S. Wabash Av. 6

SECURITY BONDS FOR CONTRACTORS.
Builders & Mfrs. Mutual Casualty Co., 133 W. Washington St. 36
Chgo. Bonding & Surety Co., 29 S. La Salle 12
Mass. Bonding & Ins. Co., 175 W. Jackson. 220
National Surety Co., 209 S. La Salle St. 220
Sherman & Ellis, Inc., 29 S. La Salle St. 4

SEPARATORS—STEAM AND OIL.
Consolidated Eng. Co., 23 Pl. & Shields 284
Webster, Warren & Co., Monmouth. 294

SEWER PIPE.

Dee, Wm. E. Co., 30 N. La Salle St.	242
Rosing, Astrid S., 111 W. Monroe St.	242

SEWERAGE EJECTORS AND BILGE PUMPS.

Chgo. Pump Co., 905 W. Lake St.	14
Yeomans Bros., 231 Institute Pl.	312

SHEATHING PAPER.

Barrett Mfg. Co., 10 S. La Salle St.	22
Bird & Son, 53 W. Jackson Bl.	328
Cabot, Samuel, 24 W. Kinzie St.	328
Cent'l Asbestos & Magnesia Co., 214 W. Grand Av.	330
Krez, Paul J., Co., 444 N. La Salle St.	330
Patent Vulcanite Roofing Co., 2256 W. 49.	34
Union Insulating Co., 20 W. Jackson Blvd	328
Watson, H. F. Co., 319 Wells St.	330

SHEET CORK—HAIR FELT AND MINERAL WOOL INSULATION.

Johns-Manville, H. W. Co., 18th & Mich.	330
Union Insulating Co., 20 W. Jackson Blvd	328

SHEET METAL WORKS.

Gustafson, K. A., 2110 N. Springfield Av.	298
Hayward, R. B. Co., 406 W. Erie St.	304
Knisely Bros., 28th Pl. & 5th Av.	274
Mellish-Hayward Co., 213 W. Austin Av.	298
Monarch Ventilating Co., 1414 N. Halsted.	302
Narowetz Heating & Ventilating Co., 223 W. Lake St.	298
Staer, Frank, 1473 N. Halsted St.	274

SHEET STEEL—BLACK AND GALVANIZED.

Am. Sheet & Tin Plate Co., 208 S. La Salle St. and Pittsburgh, Pa.	28
--	----

SHEET AND TIN PLATE.

Am. Sheet & Tin Plate Co., 208 S. La Salle St. and Pittsburgh, Pa.	28
--	----

SHELVES—STEEL FOR FACTORIES.

Federal Steel Fixture Co., 189 W. Madison	272
---	-----

SHINGLES—WOOD.

Burns, J. E. Lumber Co., 700 W. Chicago	350
Hines, Edw. Lumber Co., 2431 S. Lincoln	24
Rittenhouse & Embree Co., 3500 S. Racine	348
Schillo, Adam, Lumber Co., Kingsbury & Blackhawk St.	350
Thornton-Claney Lumber Co., 2315 Elston	26

SHINGLES (Fireproof).

Amalgamated Roofing Co., 431 S. Dearborn	224
Beckman-Dawson Co., 19 S. La Salle St.	328
Bird & Son, 53 W. Jackson Bl.	328
Johns-Manville, H. W. Co., 18th & Mich.	330

SHINGLE STAINS.

Barrett Mfg. Co., 10 S. La Salle St.	22
Cabot, Samuel, 24 W. Kinzie St.	328
Lucas, John & Co., 1362 W. 37th St.	324
Moore, Benjamin & Co., 415 N. Green.	324
Wadsworth Howland Co., 225 N. Carpenter	324

SHORING CONTRACTORS.

Friestedt, L. P. Co., Tribune Bldg.	78
-------------------------------------	----

SHOW CASE BASIN.

Brasco Mfg. Co., 1455 S. Michigan Av.	6
Kayneer Mfg. Co., 11 S. La Salle St.	4
Zouri Drawn Metals Co., 38 S. Dearborn St.	1

SHRUB AND TREE PLANTERS.

Witthold, Geo. Co., 737 Buckingham	222
------------------------------------	-----

SIDEWALK BUILDERS.

Blome-Sinek Co., 139 N. Clark St.	52
Simpson Constr. Co., 133 W. Wash.	236

SIDEWALK DOORS.

Hill, O. H. Co., 2253 St. Paul Av.	214
Smith, F. P. W. & I. Wks., 56 W. Lake.	258

SIDEWALK ELEVATORS.

Webster Engineering Co., 30 N. La Salle	336
---	-----

SIDEWALK AND VAULT LIGHTS.

Am. Luxfer Prism Co., 29 E. Madison	332
-------------------------------------	-----

SIGNALING SYSTEMS.

McFell Signal Co., 2857 S. Halsted St.	202
Wadford Electric Co., 175 W. Jackson	201

SKYLIGHTS.

Chgo. Ventilator & Iron Wks., 838 W. Austin Av.	332
Lupton, David, Sons Co., 175 W. Jackson	38

SLIDE RULES.

Tomlinson, H. W., 64 E. Van Buren St.	353
---------------------------------------	-----

SLUICE GATES.

Jenkins Bros., 300 W. Lake St.	282
--------------------------------	-----

SMOKE STACK LININGS

Cent'l Asbestos & Magnesia Co., 214 W. Grand Av.	330
Krez, Paul J., Co., 444 N. La Salle St.	330

SOIL AND SOD.

Witthold, Geo. Co., 737 Buckingham	222
------------------------------------	-----

SPIRAL CRUTES.

Alvey Mfg. Co., 327 S. La Salle St.	274
-------------------------------------	-----

STABLE FIXTURES—WIRE AND IRON.

Cent'l Iron Wks. of Chgo., 939 W. Lake	262
Columbia Wire & Iron Wks., 1929 W. Lake	260
Guaranty Iron & Wire Co., 2817 W. Lake	268
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Heath-Johnson Co., 306 W. Ontario	266
Smith, F. P. W. & I. Wks., 56 W. Lake.	258

STAIR BUILDERS.

Western Stair Wks., 3039 Elston Av.	352
-------------------------------------	-----

STAIRS AND RAILINGS.

Western Stair Wks., 3039 Elston Av.	352
-------------------------------------	-----

STAIRS—IRON AND BRONZE.

Central Arch'l Iron Wks., 3105 W. 27th	260
Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Chgo. Ornamental Iron Co., 37 & Stewart	260
Duffin Iron Co., 4001 Wentworth Av.	268
Federal Iron Wks., 30 N. La Salle St.	254
Guaranty Iron and Wire Wks., 2817 W. Lake St.	268
Halsted, Joseph, Co., 1233 W. Randolph.	256
Heath-Johnson Co., 306 W. Ontario	266
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
Standard Tyler Co., 2420 W. 15th St.	266
Sullivan-Korber Co., 2437 W. 21st Pl.	266
Union Edry Wks., 38 S. Dearborn St.	256
Winslow Bros. Co., 4600 W. Harrison St.	262
Woodbridge Ornamental Iron Co., 400 W. Erie	262

STANDARDS.

Eyerson, C. G. & Co., 70 W. Lake St.	210
Warren, Walter G. & Co., 1401 W. Jackson	210
Williamson, R. & Co., 609 W. Washington	210

STAND PIPES.

Guaranty Iron & Wire Co., 2817 W. Lake	268
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Kroeschell Bros. Co., 410 W. Erie St.	290

STEAM BOILERS.

Kewanee Boiler Co., 328 W. Washington & Kewanee, Ill.	276-277
---	---------

STEAM ELEVATORS.

Otis Elevator Co., 600 W. Jackson Bldg.	32
---	----

STEAM FITTERS & MACHINISTS.

Am. Heating & Plumbing Corp., 51 W. Rand	288
Brady & Co., 125 N. Curtis St.	300
Daly, J. J., 108 Wells St.	296
Dwyer & Co., 31 W. Illinois St.	300
Farwell, B. J., 410 S. Sherman St.	308
Gallagher & Speck, 215 W. Congress St.	302
Henrich, Geo. A., 5650 Broadway.	300
Herlihy, J. J., 754 W. Van Buren St.	300
Kirk, Geo. H., 6711 Wentworth Av.	296
Klender, W. & Co., 3140 N. Clark St.	290
Kroeschell Bros. Co., 410 W. Erie St.	292
Nacey, P. Co., 927 S. State St.	292
Peckham, Harry, Jr., 209 Milwaukee Av.	292
Phillips, Getschow Co., 130 W. Kinzie St.	290
Pope, Wm. A., 26 N. Jefferson St.	292

STEAM FITTERS' MATERIAL.

Consolidated Eng. Co., 28 Pl. & Shields	284
Davis, G. M., Regulator Co., 122 Milwaukee	298

STEAM GENERATORS.

Kewanee Boiler Co., 328 W. Washington
& Kewanee, Ill. 276-277

STEAM POWER BOILERS.

Troquois Eng. Co., 313 S. Dearborn 306

STEAM PUMPS.

Am. Steam Pump Co., 53 W. Jackson 312

STEAM SPECIALTIES

Lewis, G. M., Regulator Co., 122 Milwaukee 298
Consolidated Eng. Co., 28 Pl. & Shields 284
Hoffman Specialty Co., 130 N. 5th Av. 278
Jenkins Bros., 300 W. Lake St. 282
Johnson Service Co., 177 N. Dearborn. 294
Nat'l Regulator Co., 208 S. Jefferson. 294
Powers Regulator Co., 5 S. Wabash Av. 294
Smith V. A. Co., 213 W. Lake St. 318

STEAM TRAPS.

Consolidated Eng. Co., 28 Pl. & Shields 284
Western Valve Co., 188 N. Market St. 314

STEEL BARS FOR REINFORCING CONCRETE.

Concrete Steel Co., 53 W. Jackson Blvd. 261
Northwestern Expanded Metal Co., 107 S. Dearborn St. 18
Trussed Concrete Steel Co., 122 S. Mich. 231

STEEL ERECTORS.

Kilgore, W. B. Constr. Co., 1272 W. North 254

STEEL FABRIC FOR REINFORCING CONCRETE.

Northwestern Expanded Metal Co., 107 S. Dearborn St. 18

STEEL ROLLING DOORS, SHUTTERS AND PARTITIONS.

Dodge, H. B. & Co., 332 S. Michigan Av. 214
Guaranty Iron & Wire Co., 2417 W. Lake 261
Hank Iron & Wire Wks., N. Albany & W. Chgo. Aves. 258
Hill, O. H. Co., 2253 St. Paul Av. 241
Kianear Mfg. Co., 208 S. La Salle St. 270
Saino Fire Door & Shutter Co., 2025 Elston 270

STONE—BRIDGE.

Indiana Quarries Co., 112 W. Adams St. 1
McMillan, W. & Son, 10 S. La Salle St. Inside Front Cover.

STONE—BUILDING.

Indiana Quarries Co., 112 W. Adams St. 1
McMillan, W. & Son, 10 S. La Salle St. Inside Front Cover.
Stein-Ebertshausen & Co., 1017 West Madison St. 250
Ward, Albert J. Co., Fullerton Ave. Bridge 10

STONE CONTRACTORS.

Indiana Quarries Co., 112 W. Adams St. 1
McMillan, W. & Son, 10 S. La Salle St. Inside Front Cover.
Stein-Ebertshausen & Co., 1017 West Madison St. 250
Ward, Albert J. Co., Fullerton Ave. Bridge 10

STONE—CUT.

Indiana Quarries Co., 112 W. Adams St. 1
Stein-Ebertshausen & Co., 1017 West Madison St. 250
McMillan, W. & Son, 10 S. La Salle St. Inside Front Cover.
Ward, Albert J. Co., Fullerton Ave. Bridge 10

STONE DEALERS—IN ROUGH AND SAWED STONE.

Indiana Quarries Co., 112 W. Adams St. 1
McMillan, W. & Son, 10 S. La Salle St. Inside Front Cover.

STONE COATING.

Garden City Sand Co., 133 W. Wash. 212

STORE FRONTS—COPPER, BRASS AND BRONZE.

Brasco Mfg. Co., 1455 S. Michigan Av. 6
Kawneer Mfg. Co., 11 S. La Salle St. 4
Zouri Drawn Metals Co., 38 S. Dearborn St. 1

STORE FRONTS—LIGHT METAL CONSTRUCTION.

Brasco Mfg. Co., 1455 S. Michigan Av. 6
Kawneer Mfg. Co., 11 S. La Salle St. 4
Zouri Drawn Metals Co., 38 S. Dearborn St. 1

STORE FRONTS—PLATE GLASS.

Brasco Mfg. Co., 1455 S. Michigan Av. 6
Kawneer Mfg. Co., 11 S. La Salle St. 4
Zouri Drawn Metals Co., 38 S. Dearborn St. 1

STORE AND OFFICE FIXTURES.

Brunswick-Balke-Collender Co., 623 S. Wabash Av. 6
Newton & Hoyt Co., 1048 S. Wabash Av. 14
Pick, Albert & Co., 1200 W. 35th St. 226
Schweizer & West Mfg. Co., 319 N. Ada. 352

STOVES—GAS.

Peoples Gas Light & Coke Co., Michigan Av. & Adams St. 218

STUCCO, INTERIOR AND EXTERIOR

Nat'l Kellastone Co., 19 S. La Salle St. 238

SURETY BONDS.

Builders & Mfrs. Mutual Casualty Co., 133 W. Washington St. 36
Chgo. Bonding & Surety Co., 29 S. La Salle 12
Mass. Bonding & Ins. Co., 175 W. Jackson. 220
National Surety Co., 209 S. La Salle St. 220
Sherman & Ellis, Inc., 29 S. La Salle St. 4

SURVEYORS—CITY AND COUNTY.

Greeley-Howard-Nortin Co., 30 N. La Salle 216
Jones, W. D. & S. S. Dearborn St. 216
Slander, A. L., 30 N. La Salle St. 216
Suhr & Berryman, 139 N. Clark St. 216

SURVEYORS' SUPPLIES.

Am. Blue Print Paper Co., 335 Plymouth 334

TABLETS AND NAMEPLATES—IRON AND BRONZE.

Chgo. Architectural Bronze Co., 519 W. Van Buren St. 260
Chgo. Ornamental Iron Co., 37 & Stewart 260
Halsted, Joseph, Co., 1233 W. Randolph. 256
Heath-Johnson Co., 306 W. Ontario 266
Smith, F. P. W. & I. Wks., 56 W. Lake. 258
Standard Tyler Co., 2420 W. 15th St. 266
Sullivan-Korber Co., 2437 W. 21st Pl. 266
Winslow Bros. Co., 4600 W. Harrison St. 262
Woodbridge Ornamental Iron Co., 400 W. Erie 262

TANKS—AUTOMATIC SPRINKLER.

Wendnagel & Co., 22nd & Jefferson Sts. 270

TANKS—IRON AND STEEL.

Kaestner & Hecht Co., 500 S. Throop St. 264
Kewanee Boiler Co., 328 W. Washington & Kewanee, Ill. 276-277
Kroeschell Bros. Co., 140 W. Erie St. 290
Wendnagel & Co., 22nd & Jefferson Sts. 270

TANKS—NICKEL PLATERS.

Alberene Stone Co., 214 N. Clinton St. 246

TANKS—WOOD.

Wendnagel & Co., 22nd & Jefferson Sts. 270

TEAMING.

Ottenhoff, Conrad, 1214 S. Leavitt St. 68

TELEPHONE INSTALLATION.

Chgo. Telephone Co., 212 W. Wash. 228

TELEPHONES FOR PUBLIC AND PRIVATE USE.

Chgo. Telephone Co., 212 W. Wash. 228

TEMPERATURE REGULATORS.

Annex Co., 175 W. Jackson Blvd. and Knoxville, Tenn. 310
Consolidated Eng. Co., 28 Pl. & Shields 284
Ill. Malleable Iron Co., 1801 Diversey 318
Johnson Service Co., 177 N. Dearborn. 294
Nat'l Regulator Co., 208 S. Jefferson. 294
Powers Regulator Co., 5 S. Wabash Av. 294
Webster, Warren & Co., Monahock. 294

TERRA COTTA.

Advance Terra Cotta Co., 29 S. La Salle 246
Am. Terra Cotta & Ceramic Co., 122 S. Mich. 246
Midland Terra Cotta Co., 11 S. La Salle. 40
Northwestern Terra Cotta Co., 2525 Clyb'n 10

THERMOSTATS.

Johnson Service Co., 177 N. Dearborn. 294
Nat'l Regulator Co., 208 S. Jefferson. 294
Powers Regulator Co., 5 S. Wabash Av. 294

TILE—CERAMIC, ETC.

Art Marble Co., 2608 Flournoy St.	248
Davis Marble Co., 1450 W. North Ave.	248
Flavin Marble Mill, 3542 Shields Av.	250
Interior Tiling Co., 21 E. Van Buren St.	248
Marthens, Chester N., Marble Co., 53rd & Wallace Sts.	248
Mosaic Tile Co., 104 S. Michigan Av.	250

TILE—FLOORS.

Art Marble Co., 2608 Flournoy St.	248
Davis Marble Co., 1450 W. North Ave.	248
Flavin Marble Mill, 3542 Shields Av.	250
Interior Tiling Co., 21 E. Van Buren St.	248
Marthens, Chester N., Marble Co., 53rd & Wallace Sts.	248
Mosaic Tile Co., 104 S. Michigan Av.	250

TILE—GYPSUM.

U. S. Gypsum Co., 205 W. Monroe St.	20
-------------------------------------	----

TILE—HOLLOW

Dee, Wm. E. Co., 30 N. La Salle St.	242
Johnson E. V., 80 E. Jackson Blvd.	238
Nat'l Fire Proofing Co., 327 S. La Salle.	238
Rosing, Astrid S., 111 W. Monroe St.	242

TILE—RUBBER.

N. Y. Belting & Packing Co., 124 W. Lake	222
--	-----

TILE—WALL.

Art Marble Co., 2608 Flournoy St.	248
Davis Marble Co., 1450 W. North Ave.	248
Flavin Marble Mill, 3542 Shields Av.	250
Interior Tiling Co., 21 E. Van Buren St.	248
Marthens, Chester N., Marble Co., 53rd & Wallace Sts.	248
Mosaic Tile Co., 104 S. Michigan Av.	250

TIN AND TERNE PLATES.

Am. Sheet & Tin Plate Co., 208 S. La Salle St. and Pittsburgh, Pa.	28
--	----

TRAPS FOR PLUMBING FIXTURES.**TRAPS—STEAM.**

Consolidated Eng. Co., 28 Pl. & Shields	284
Davis, G. M., Regulator Co., 422 Milw'kee	298

TREE AND SHRUB PLANTERS.

Witthold, Geo. Co., 757 Buckingham	222
------------------------------------	-----

TRUSSES—WOOD.

McKeown Bros., 4817 Cottage Grove Av.	71
---------------------------------------	----

TUBING.

Nat. Tube Co., 208 S. La Salle St. & Pittsburgh, Pa.	30
--	----

TUBING—METAL.

Brasco Mfg. Co., 1455 S. Michigan Av.	6
Kawneer Mfg. Co., 11 S. La Salle St.	4
Zouri Drawn Metals Co., 38 S. Dearborn St.	1

TURN TABLES.

American Bridge Co., 208 S. La Salle St.	252
Jennet Bridge & Iron Wks., 3541 Shields.	338
Kenwood Bridge Co., 1st Nat. Bk. Bldg.	256

URINAL STALLS.

Alberene Stone Co., 214 N. Clinton St.	246
--	-----

VALVES—AIR.

Davis, G. M., Regulator Co., 422 Milw'kee	298
Dole Valve Co., The, 208 N. 5th Av.	314
Hoffman Specialty Co., 130 N. 5th Av.	278
Jenkins Bros., 300 W. Lake St.	282
Scott Valve Co., 310 W. Randolph St.	314

VALVES—AIR LINE.

Hoffman Specialty Co., 130 N. 5th Av.	278
---------------------------------------	-----

VALVES—AIR, CHECK BALANCE.

Davis, G. M., Regulator Co., 422 Milw'kee	298
Scott Valve Co., 310 W. Randolph St.	314

VALVES—BACK PRESSURE.

Consolidated Eng. Co., 28 Pl. & Shields	284
Davis, G. M., Regulator Co., 422 Milw'kee	298
Dole Valve Co., The, 208 N. 5th Av.	314
Jenkins Bros., 300 W. Lake St.	282
Scott Valve Co., 310 W. Randolph St.	314

VALVES—BLOW OFF.

Scott Valve Co., 310 W. Randolph St.	314
--------------------------------------	-----

VALVES—FLUSH.

Sloan Valve Co., 617 W. Jackson Blvd.	311
---------------------------------------	-----

VALVES—GATE.

Scott Valve Co., 310 W. Randolph St.	314
--------------------------------------	-----

VALVE MANUFACTURERS.

Consolidated Eng. Co., 28 Pl. & Shields	284
Davis, G. M., Regulator Co., 422 Milw'kee	298
Dole Valve Co., The, 208 N. 5th Av.	314
Hoffman Specialty Co., 130 N. 5th Av.	278
Jenkins Bros., 300 W. Lake St.	282
Scott Valve Co., 310 W. Randolph St.	314
Western Valve Co., 188 N. Market St.	311

VALVES—PACKLESS.

Dole Valve Co., The, 208 N. 5th Av.	314
-------------------------------------	-----

VALVES PACKLESS RADIATOR.

Troquois Eng. Co., 343 S. Dearborn	306
------------------------------------	-----

VALVES—POP.

Scott Valve Co., 310 W. Randolph St.	314
--------------------------------------	-----

VALVES—PRESSURE REDUCING.

Consolidated Eng. Co., 28 Pl. & Shields	284
Dole Valve Co., The, 208 N. 5th Av.	314
Jenkins Bros., 300 W. Lake St.	282
Scott Valve Co., 310 W. Randolph St.	314

VALVES—RADIATOR.

Troquois Eng. Co., 343 S. Dearborn	306
------------------------------------	-----

VALVES—REGULATING.

Davis, G. M., Regulator Co., 422 Milw'kee	298
Dole Valve Co., The, 208 N. 5th Av.	314
Scott Valve Co., 310 W. Randolph St.	314

VALVES—RELIEF.

Davis, G. M., Regulator Co., 422 Milw'kee	298
Scott Valve Co., 310 W. Randolph St.	314

VALVES—SIPHON AIR.

Hoffman Specialty Co., 130 N. 5th Av.	278
---------------------------------------	-----

VALVES—VACUUM.

Consolidated Eng. Co., 28 Pl. & Shields	284
Davis, G. M., Regulator Co., 422 Milw'kee	298
Hoffman Specialty Co., 130 N. 5th Av.	278
Scott Valve Co., 310 W. Randolph St.	314
Webster, Warren & Co., Monadnock.	294

VALVES—VENT AIR.

Hoffman Specialty Co., 130 N. 5th Av.	278
---------------------------------------	-----

VAPOR HEATING.

Arcade Steam Heating Co., 126 W. Kenzie	304
Chicago Steam Heating Co., 169 N. Jeff.	304
Consolidated Eng. Co., 28 Pl. & Shields	284
Glendon-Bielke Co., 546 W. Lake St.	304
Klender, W. & Co., 3110 N. Clark St.	306
Noble & Thumm, 2315 Lincoln Av.	292
Peckham, Harry, Jr., 209 Milwaukie Av.	292
Phillips, Getschow Co., 130 N. Kenzie	290
Russell, J. E., & Co., 154 W. Randolph.	318
Spencer Heater Co., 80 E. Jackson Blvd.	286
Webster, Warren & Co., Monadnock	294

VARNISHES.

Adams & Elting Co., 716 Washington Bl.	324
Chgo. Varnish Co., 2100 Elston Av.	322
Moore, Benjamin & Co., 415 N. Green.	321
Murphy Varnish Co., 50 W. 22nd St.	322
Pratt & Lambert, 320 W. 26th St.	322
Standard Varnish Wks., 2606 Federal	320

VENETIAN BLINDS.

Dodge, H. B. & Co., 332 S. Michigan Av.	214
---	-----

VENTILATORS.

Blomfeldt & Rapp Co., 108 N. Jefferson	284
Chgo. Ventilator & Iron Wks., 838 W. Austin Av.	332
Gustafson, K. A., 2110 N. Springfield Av.	298
Hayward, R. B. Co., 106 W. Erie St.	304
Kernchen Co., 332 S. Michigan Av.	338
Mellish-Hayward Co., 213 W. Austin Av.	298
Monarch Ventilating Co., 1111 N. Halsted.	392
Narowetz Heating & Ventilating Co., 223 W. Lake St.	298

VENTILATING APPARATUS.

Am. Heating & Plumbing Corp., 514 W. Rand.	288
Batterman Truitt Co., 18 E. Kinzie St.	312
Blomfeldt & Rapp Co., 108 N. Jefferson	284
Chgo. Steam Heating Co., 169 N. Jefferson	304
Chgo. Ventilator & Iron Wks., 838 W. Austin Av.	332
Claffey, E. J. Co., 12 W. Illinois St.	288
Commonwealth Edison Co., 72 W. Adams	208
Consolidated Eng. Co., 28 Pl. & Shields	284
Daly, J. J., 108 Wells St.	296
Dwyer & Co., 31 W. Illinois St.	300
Graves Heating Co., 162 N. Desplaines	292
Gustafson, K. A., 2110 N. Springfield Av.	298
Hanley-Casey Mech. Equip. Co., 110 W. Ohio St.	306

Hayward, R. B. Co., 406 W. Erie St.	304
Henrich, Geo. A., 5650 Broadway.	300
Johnson, C. W., inc. 614 Wash. Blvd.	296
Kelm Bros. Co., 15 W. Kinzie St.	290
Kernchen Co., 332 S. Michigan Av.	338
Kilander, A. & Co., 126 S. Clinton St.	296
Kirk, Geo. H., 6711 Wentworth Av.	296
Klender, W. & Co., 3140 N. Clark St.	306
Lupton, David, Sons Co., 175 W. Jackson	38
McDonough, E. J. Co., 19 W. Kinzie St.	302
Mehring & Hanson Co., 118 N. Franklin	288
Mellish-Hayward Co., 213 W. Austin Av.	298
Monarch Ventilating Co., 1414 N. Halsted.	302
Mueller, L. J. Furnace Co., 182 N. Dear.	316
Nacey, P. Co., 927 S. State St.	292
Narowitz Heating & Ventilating Co., 223 W. Lake St.	298
New York Blower Co., 337 W. 25th Pl. Inside Front Cover.	
Peckham, Harry, Jr., 209 Milwaukee Av.	292
Phillips, Getschow Co., 130 W. Kinzie St.	290
Prentice, L. H. Co., 328 Sherman St.	290
Reynolds, B. E. & Co., 412 N. Dearborn.	316
Rigby, Ben, 545 W. Lake St.	310
Robinson Furnace Co., 205 W. Lake St.	316
Russell, J. E. & Co., 154 W. Randolph.	318
Stein, Carl John, Co., 853 S. State St.	304
Webster, Warren & Co., Monadnock.	294

VACUUM SYSTEM OF HEATING.

Arcade Steam Heating Co., 126 W. Kenzie	304
Chicago Steam Heating Co., 169 N. Jeff.	304
Consolidated Eng. Co., 28 Pl. & Shields	284
Glemon-Bielke Co., 546 W. Lake St.	304
Iroquois Eng. Co., 343 S. Dearborn	306
Noble & Thumm, 2313 Lincoln Av.	310
Peckham, Harry, Jr., 209 Milwaukee Av.	292
Phillips, Getschow Co., 130 N. Kenzie	290
Russell, J. E. & Co., 154 W. Randolph.	318
Webster, Warren & Co., Monadnock	294

WALL BEDS.

Am. Wall Bed Co., 1339 W. 21st St.	226
------------------------------------	-----

WALL BEDS—OSCILLATING AND PORTABLE.

Van Dame, W. L., 58 E. Washington St.	2
---------------------------------------	---

WALL BOARD.

Bird & Son, 53 W. Jackson Bl.	328
Cornell Wood Products Co., 175 West Jackson Blvd. Inside Back Cover.	

WALL COPING.

Dee, Wm. E. Co., 30 N. La Salle St.	242
Garden City Sand Co., 133 W. Wash.	242
Johnson E. V., 80 E. Jackson Blvd.	238
Northwestern Terra Cotta Co., 2525 Clyb'rn 10	
Rosing, Astrid S., 111 W. Monroe St.	242

WALL DECORATORS

Gleich, T. C., 2860 Broadway.	326
Moore, Benjamin & Co., 415 N. Green.	324
Spierling & Linden, 1216 Michigan Av.	326
Standard Varnish Wks., 2606 Federal	320
Wadsworth Howland Co., 225 N. Carpenter	324

WALL PAPER.

Gleich, T. C., 2860 Broadway.	326
Noelle, J. B. Co., 702 Wells St.	326
Spierling & Linden, 1216 Michigan Av.	326
Sullivan, J. P., 4515 Indiana Av.	326

WALL PLASTER.

Garden City Sand Co., 133 W. Wash.	242
U. S. Gypsum Co., 205 W. Monroe St.	20

WALL PLUGS.

Zouri Drawn Metals Co., 38 S. Dearborn St.	1
--	---

WARDROBES—VENTILATED.

Dodge, H. B. & Co., 332 S. Michigan Av.	214
Federal Steel Fixture Co., 189 W. Mad.	272
Smith, F. P. W. & I. Wks., 56 W. Lake.	258

WASHING MACHINES—ELECTRIC.

Chgo. Dryer Co., 630 S. Wabash Av.	212
Pick, Albert & Co., 1200 W. 35th St.	226

WATER CLOSET VALVE.

Sloan Valve Co., 617 W. Jackson Blvd.	314
---------------------------------------	-----

WATER FILTERS.

Everson, C. G. & Co., 70 W. Lake St.	210
--------------------------------------	-----

WATER FILTERS AND WATER SUPPLY SYSTEM.

Dwyer & Co., 31 W. Illinois St.	300
Nacey, P. Co., 927 S. State St.	292

WATER HEATERS.

Economy Heater Co., 108 S. La Salle St.	280
Kewanee Boiler Co., 328 W. Washington & Kewanee, Ill.	276-277

WATERPROOFING.

Barrett Mfg. Co., 10 S. La Salle St.	22
Bird & Son, 53 W. Jackson Bl.	328
Ceresit Waterproofing Co., 110 S. Dear.	230
de Smet, Geo. W., 133 W. Washington	236
Garden City Sand Co., 133 W. Wash.	242
Imperial Water Proof Co., 105 W. Monroe	230
Johns-Manville, H. W. Co., 18th & Mich.	330
Seofield, Evans & Co., 24 E. 8th St.	234
Union Insulating Co., 20 W. Jackson Blvd	328

WEATHER STRIPS—METAL.

Burrowes, E. T. Co., 140 S. Dearborn St.	16
Chamberlin Metal Weather Strip Co., 626 S. Dearborn	230
Robbins Mfg. Co., 53 W. Jackson Blvd.	230
Van Dame, W. L., 58 E. Washington St.	2

WINDOWS—REVERSIBLE.

McFarland & Hyde Co., 2701 S. 5th Av.	8
---------------------------------------	---

WINDOWS—WIRE GLASS.

Mississippi Wire Glass Co., 7 W. Madison.	332
---	-----

WINDOW ADJUSTERS.

Wilkins, George Lester, 7067 N. Clark St.	272
---	-----

WINDOW AND DOOR SCREENS

Burrowes, E. T. Co., 140 S. Dearborn St.	16
Chamberlin Metal Weather Strip Co., 626 S. Dearborn	230
Robbins Mfg. Co., 53 W. Jackson Blvd.	230
Van Dame, W. L., 58 E. Washington St.	2

WINDOW OPENERS.

Wilkins, George Lester, 7067 N. Clark St.	272
---	-----

WIRE GLASS.

Mississippi Wire Glass Co., 7 W. Madison.	332
---	-----

WIRE—INSULATED.

Hazard Mfg. Co., 552 W. Adams St.	34
-----------------------------------	----

WIRE ROPE.

Hazard Mfg. Co., 552 W. Adams St.	34
-----------------------------------	----

WIRE—RUBBER COVERED.

Hazard Mfg. Co., 552 W. Adams St.	34
-----------------------------------	----

WIRE WORK.

Cent'l Iron Wks. of Chgo., 939 W. Lake	262
Chgo. Architectural Bronze Co., 519 W. Van Buren St.	260
Chgo. Ornamental Iron Co., 37 & Stewart	260
Columbia Wire & Iron Wks., 1929 W. Lake	260
Duffin Iron Co., 4001 Wentworth Av.	268
Federal Iron Wks., 30 N. La Salle St.	254
Guaranty Iron & Wire Co., 2847 W. Lake	268
Halsted, Joseph, Co., 1233 W. Randolph.	256
Hanke Iron & Wire Wks., N. Albany & W. Chgo. Aves.	258
Heath-Johnson Co., 306 W. Ontario	266
Smith, F. P. W. & I. Wks., 56 W. Lake.	258
Standard Tyler Co., 2420 W. 15th St.	266
Sullivan-Korber Co., 2437 W. 21st Pl.	266
Union Fdry Wks., 38 S. Dearborn St.	256
Winslow Bros. Co., 4600 W. Harrison St.	262
Woodbridge Ornamental Iron Co., 400 W. Erie	262

WOOD CARVING.

Architectural Dec. Co., 1600 S. Jefferson	346
Decorators Sup. Co., 2547 Archer Av.	338
Dux, Joseph, 2112 W. Van Buren St.	346
Tudor, J. T., 455 W. Chicago Av.	346
Zettler, A., 458 N. Sangamon St.	346

WOOD FIBRE BOARD.

Cornell Wood Products Co., 175 West Jackson Blvd. Inside Back Cover.	
--	--

WOOD FINISHING.

Gleich, T. C., 2860 Broadway.	326
Noelle, J. B. Co., 702 Wells St.	326

WOOD PILES.

Lake Superior Piling Co., 961 W. 22nd St.	78
---	----

WOOD MANTELS AND CONSOLES.

Colonial Fire Place Co., 4611 W. 12th.	38
--	----

INDEX TO ADVERTISERS.

A	PAGE		PAGE
Adams and Elting Co.....	324	Central Asbestos and Magnesite Co....	330
Advance Roofing and Sheet Metal Works	274	Central Iron Works of Chicago.....	262
Advance Terra Cotta Co.....	246	Ceresit Waterproofing Co.....	230
Alabama Marble Co.....	80	Chaney-Archibald Co.	74
Alberene Stone Co.....	246	Chamberlin Metal Weather Strip Co..	230
Allen, W. D. Manufacturing Co.....	222	Chicago Architectural Bronze Co.....	260
Allis Brick Co.....	244	Chicago Bonding and Surety Co.....	12
Alvey Manufacturing Co.....	274	Chicago Dryer Co.....	212
Amalgamated Roofing Co.....	224	Chicago Foundation Co.....	70
American Blue Print Paper Co.....	334	Chicago Ornamental Iron Co.....	260
American Bridge Co.....	252	Chicago Portland Cement Co.....	24
American Heating and Plumbing Corp.	288	Chicago Pump Co.....	14
American Luxfer Prism Co.....	332	Chicago Steam Heating Co.....	304
American Sheet and Tin Plate Co...	28	Chicago Telephone Co.....	228
American Steam Pump Co.....	312	Chicago Varnish Co.....	322
American Steel Window Co.....	272	Chicago Ventilator and Iron Works..	332
American Terra Cotta & Ceramic Co., The	246	Claffey, E. J. Co.....	288
American Wall Bed Co.....	226	Clark, C. Everett Co.....	46
Anderson, A. and E. Co.....	48	Colonial Fireplace Co.....	38
Anderson and Lind Manufacturing Co.	352	Columbia Wire and Iron Works, The..	260
Anderson-Stevens Co.	52	Commonwealth Edison Co.....	208
Angert Wire & Iron Works.....	254	Comstock, L. K. & Co. Inc.....	200
Annex Company, The.....	310	Concrete Steel Co.....	264
Appel, Henry L. Co.....	54	Consolidated Engineering Co.....	284
Arcade Steam Heating Co.....	306	Corboy, M. J. Co.....	308
Architectural Decorating Co.....	346	Corn Exchange National Bank, The..	36
Arrow-Conductor Co., The.....	78	Cornell Wood Products Co.....	
Art Marble Co.....	248	.....Inside Back Cover	
Art Metal Fire-Proof Door & Trim Co.	274	Crockett, William P. Co.....	202
Atlas Roofing Co.....	224	Crofoot, Nielsen & Co.....	334
		Cuthbert Electrical Manufacturing Co.	200
B		Curran, Wm. J.....	344
Baird and Warner.....	220	Curtis Door and Sash Co.....	18
Balbatches, William Co.....	342	D	
Balkin Construction Co.....	54	Daly, J. J.....	296
Barnard, H. B.....	52	Davis, G. M. Regulator Co.....	298
Barrett Company, The.....	22	Davis Marble Co.....	248
Barton Spider-Web System, The.....	232	Decorators Supply Co., The.....	338
Batterman Truitt Co.....	312	Dee, Wm. E. Co.....	242
Beckman-Dawson Co., The.....	328	de Smet, George W.....	236
Benjamin Electric Mfg. Co.....	202	Dodge, H. B. & Co.....	214
Bird and Son.....	328	Doherty, Frank E.....	58
Blome-Sinek Co.	52	Dole Valve Co., The.....	314
Blomfeldt and Rapp Co.....	284	Dowling & Rutherford.....	62
Bolter's, A. Sons.....	252	Duffin Iron Co.....	268
Brady & Co.....	300	Dunning, W. N. Construction Co....	76
Brasco Manufacturing Co.....	6	Dux, Joseph.....	346
Braun, J. G.....	272	Dwyer, James J. Co.....	342
Brownell Improvement Co.....	236	Dwyer & Co.....	300
Brunswick-Balke-Collender Co., The..	6	E	
Builders and Manufacturing Mutual Casualty Co.	36	Economy Heater Co.....	280
Bulley & Andrews.....	72	Ericsson, Henry Co.....	214
Burke, Frank.....	74	Eureka Smokeless Furnace Co.....	282
Burns, John E. Lumber Co.....	350	Everson, C. G. & Co.....	210
Burrowes, E. T. Co., The.....	16	F	
Butler Street Foundry and Iron Co..	262	Farwell, B. J.....	308
B-W. Construction Co.....	58	Federal Iron Works.....	254
C		Federal Steel Fixture Co.....	272
Cabot, Samuel Inc.....	328	Flat Slab Patents Co.....	232
Cadenhead Co.....	50	Flavin Marble Mill.....	250
Carey Brick Co.....	244	Friedstedt, L. P. Co.....	78
Carter, W. G. Co.....	58	Fuller, George A. Co.....	44
Casey Construction Co.....	70	G	
Central Architectural Iron Works.....	260	Gallaher & Speck.....	302

	PAGE
German-American Portland Cement Works	240
Gindele, Charles W. Co.	70
Gleich, T. C. Co.	326
Glennon-Bielke Co.	304
Goss & Guise.	344
Graves Heating Co.	292
Greeley-Howard-Norlin Co.	216
Greenbaum Sons Bank and Trust Co.	220
Griffiths, John & Son Co.	42
Guaranty Iron and Wire Co.	268
Gustafson, K. A.	298

H

Halligan, Eugene J.	206
Halsted, Joseph Co.	256
Hanke Iron and Wire Works.	258
Hanley-Casey Mechanical Equipment Co.	306
Hanson Brothers Co.	62
Hayward, R. B. Co.	304
Hazard Manufacturing Co.	34
Heath-Johnson Co.	266
Heine Chimney Co., The.	246
Henrich, George A.	300
Herbert Boiler Co.	318
Herlihy, J. J.	300
Hewitt, J. P. & Co.	206
Hill, O. H. Co.	214
Hines, Edward Lumber Co.	24
Hoffman Electric Co.	204
Hoffman Specialty Co.	278
Holmes, Pyott & Co.	258
Hub Electric Co.	204
Hunt, Robert W. & Co.	334
Hydraulic Sand and Transit Co.	242

I

Illinois Brick Co.	244
Illinois Malleable Iron Co.	318
Illinois Society of Architects.	199
Imperial Water Proof Co., Ltd.	230
Indiana Quarries Co.	1
Interior Tiling Co.	248
Iroquois Engineering Co.	306

J

Jeffrey, John Co.	70
Jenkins Bros.	282
Jennet Bridge and Iron Works.	338
Jensen & Steenhil.	62
Johns-Manville, H. W. Co.	330
Johnson, Charles B. & Son.	74
Johnson, C. W. Inc.	296
Johnson, E. V.	238
Johnson Service Co.	294
Jones Construction Co.	72
Jones, W. D.	216

K

Kaestner & Hecht Co.	261
Kalehbrunner, J.	64
Kausal, Benedict A.	204
Kawner Manufacturing Co.	4
Kehm Bros. Co.	290
Kerwood Bridge Co.	256
Kerchen Co.	338
Kerner Incinerator Co.	78
Kewanee Boiler Co.	276-277
Kilander, A. & Co.	296
Kilgore, W. B. Construction Co., The.	254
Kinnear Manufacturing Co., The.	270
Kirk, George H.	296
Kirkland Construction Co.	61

	PAGE
Klender, William & Co.	306
Knisely Bros.	274
Krahl Construction Co.	54
Krez, Paul J. & Co.	330
Kroeschell Bros. Co.	290

L

Lake Superior Piling Co.	78
Lally Column Co.	268
Lamont, L. H. & Co.	202
Lanquist & Hlsley Co.	46
Ledgerwood, A. J. Co.	48
Lees, William	302
Lennox-Haldeman Co.	340
Leonard Construction Co.	42
Lindell, Gust	76
Lucas, John & Co., Inc.	324
Lupton, David Sons Co.	38
Lynch, Austin J. Co.	52

M

Marquette Cement Manufacturing Co.	240
Marthens, Chester N. Marble Co.	248
Martin Construction Co.	64
Massachusetts Bonding and Insurance Co.	220
Matot, D. A.	212
Mavor, William Co.	44
McCray Refrigerator Co.	12
McDonough, E. J. Co.	302
McFarland-Hyde Co.	8
McFell Signal Co.	202
McKeown Bros.	74
McLennan Construction Co.	50
McMillan, James & Co.	316
McMillan, W. & Son.	

Inside Front Cover

McNulty Bros. Co.	340
Mehring & Hanson Co.	288
Mellish-Hayward Co.	298
Menke-Thielberg Co.	48
Meyne, Gerhardt F.	66
Middleton, Edward Co.	340
Midland Terra Cotta Co.	40
Mississippi Wire Glass Co.	332
Monarch Ventilating Co., The.	302
Moore, Benjamin & Co.	324
Morava Construction Co.	256
Moreland, H. D. Co.	58
Morgan Sash and Door Co.	

Inside Back Cover

Moses, C. A. Construction Co.	56
Mosaic Tile Co., The.	250
Mueller, L. J. Furnace Co.	316
Murphy Plumbing Co.	308
Murphy Varnish Co.	322
Mutual Construction Co.	68

N

Nacey, P. Co.	292
Narowetz Heating and Ventilating Co.	298
National Automatic Door Co.	16
National Fire Proofing Co.	238
National Kellastone Co.	238
National Regulator Co.	294
National Surety Co.	220
National Tube Co.	30
National X-Ray Reflector Co.	206
Naylor, Thomas C.	64
Nelson, R. J. Co.	308
Newgard, Henry & Co.	200
Newton & Hoyt Co., The.	14
New York Belting and Packing Co.	222

	PAGE		PAGE
New York Blower Co., Inside Front Cover		Spencer Heater Co.	286
Nicholson-Zimmerman Co.	50	Staar, Frank	274
Nelson Bros.	288	Standard Roofing Co., The	224
Nilson, G. Albin	310	Standard-Tyler Co., The	266
Noble & Thumm	310	Standard Varnish Works	320
Noelle, J. B. Co.	326	Stannard Power Equipment Co.	312
Nollau & Wolff Manufacturing Co., The	352	Stein, Carl John Co.	304
North Branch Flooring Co.	350	Stein, Ebertshaeuser & Co.	250
North Western Expanded Metal Co.	18	Stern-Smith Co., The	342
Northwestern Terra Cotta Co., The	10	Stewart, James & Co.	42
O		Stiles, George W. Construction Co.	66
Olson, J. E.	68	Strandberg, E. P. Co.	56
Olson, Peter Co.	60	Suhr & Berryman	216
Orr & Lockett Hardware Co.	212	Sullivan, J. P.	326
Otis Elevator Co.	32	Sullivan-Korber Co.	266
Ottenhoff, Conrad	68	Sutton Plastering Co.	342
P		T	
Parent, N. J. Co.	344	Tablet and Ticket Co., The	226
Paschen Brothers	56	Thomas Elevator Co.	336
Patent Vulcanite Roofing Co.	34	Thompson-Starrett Co.	44
Peckham, Harry Jr.	292	Thomson, George & Son Co.	68
Peoples Gas Light & Coke Co., The	218	Thernton-Clauey Lumber Co.	26
Phillips, Getschow Co.	290	Todd, James & Co.	66
Pick, Albert & Co.	226	Tomlinson, Henry W.	353
Pierce Electric Co.	206	Troy Laundry Machinery Co.	212
Pope, William A.	292	Trussed Concrete Steel Co.	234
Powers Regulator Co., The	294	Tudor, J. T.	346
Pratt & Lambert, Inc.	322	U	
Prentice, L. H. Co.	290	Union Foundry Works	256
R		Union Insulating Co., The	328
Ranen, Math	60	Union Welded Products Co.	2
Raymond Concrete Pile Co.	236	United States Gypsum Co.	20
Reder Foundry Co.	266	Utica Hydraulic Cement Co.	210
Regnell, B. J. Co.	66	V	
Renaud, F. D.	224	Van Dame, W. L. Co.	2
Reynolds, B. F. & Co.	316	Variety Manufacturing Co.	270
Rigby, Ben, Inc.	310	Vierling Steel Works	268
Rittenhouse & Embree Co.	348	Voss, Frederick	222
Robbins Manufacturing Co., The	230	W	
Robinson Furnace Co.	316	Wadeford Electric Co.	204
Rodatz, Jacob	62	Wadsworth-Howland Co.	324
Rosenthal, O. W. Co.	72	Waldman Construction Co.	76
Rosing, Astrid S.	242	Walger Awning Co.	226
Russell, J. E. & Co.	318	Ward, Albert J. Co.	40
S		Warren, Walter G. & Co.	210
Saino Fire Door and Shutter Co.	270	Watson, H. F. Co.	330
Salomon-Waterton Co.	60	Webster Engineering Co.	336
Samuelson, A. J.	76	Webster, Warren & Co.	294
Sasgen Derrick Co.	336	Weir & Craig Manufacturing Co.	286
Scharmer Construction Co., The	60	White City Electric Co.	200
Schillo, Adam Lumber Co.	350	Weller Manufacturing Co.	336
Schmidt Brothers Construction Co.	56	Wells Brothers Co.	12
Schweizer & West Manufacturing Co.	352	Wendnagel Co.	270
Seofield, Evans & Co.	234	Western Brick Co.	244
Scott Valve Co.	314	Western Stair Works	352
Shankland, E. C. & R. M.	334	Western Valve Co.	314
Shedden, James & Co.	46	Wilce, T. Co., The	348
Sherman & Ellis, Inc.	4	Wilkins, George Lester	272
Silander, A. I.	216	Williams-Wendt Co.	250
Simmens, J. L. Co.	50	Williams, William	314
Simpson Construction Co.	236	Williamson, R. & Co.	210
Slean Valve Co.	314	Wilson, R. F. & Co.	48
Smith, F. P. Wire and Iron Works	258	Winslow Bros. Co.	262
Smith, V. A. Co.	318	Witthold, George Co., The	222
Snyder, J. W. Co.	14	Woodbridge Ornamental Iron Co.	262
Sollitt, Ralph & Sons Construction Co.	54	Y	
Sollitt, Sumner Co.	46	Yeomans Brothers Co.	312
South Halsted Street Iron Works	258	Z	
Spiering, Ed	72	Zander-Reum Co.	310
Spierling & Linden	326	Zettler, A.	316
		Zouri Drawn Metals Co.	1

TABLE OF CONTENTS.

	PAGE
Acoustics, Architectural	337
Advertisers, Alphabetical List of.....	429
Advertisers, Classified List of.....	409
Announcement	9
Architects, Alphabetical List of.....	35
Building Ordinance of the City of Chicago.....(See Index, Page 81)	96
Canons of Professional Ethics of the Illinois Society of Architects.....	25
Catalogues, and Printed Matter, Suggestions for Firms Issuing Same.....	347
Charges, Proper Minimum, Schedule of and Professional Practice of Architects Recommended by the Illinois Society of Architects.....	31
Chicago Architectural Club, Officers and Members, List of.....	69
Chicago Telephone Company, Suggestions for the Provisions of Wiring and Cabling of Buildings for Service.....	229
City Hall and County Building Information and Guide.....	77
City Officials, Chicago.....	75
Coal Consumed During Heating Season, Chart Showing.....	293
Commonwealth Edison Co.'s System Rules and Information Pertaining to Electric Service, Meters and Wiring.....	209
Concrete and Excavation Work, Rules of Measurement for.....	241
Concrete Floors, Plain, Specifications for.....	247
Coverings, Protective, Preservative and Decorative.....	325
Flat Slab Construction.....	233
Forms and Documents Issued by the Illinois Society of Architects, Prices of.....	199
Gas Fitters' Rules for Piping Buildings, Peoples Gas Light and Coke Co.'s System.....	219
Glass and Glazing.....	333
Editorial Illinois Society of Architects.....	21
Electrical Inspections, Sections of the Chicago Code Governing Same.....	203
Electricity, Department of the City of Chicago.....	201
Engravings—	
Board of Arbitration of the Illinois Society of Architects.....	15
Committee on Public Action of the Illinois Society of Architects.....	17
Directors of the Illinois Society of Architects.....	13
Officers of the Illinois Society of Architects.....	11
State Board of Examiners of Architects.....	19
Excavation and Concrete Work, Rules of Measurement for.....	241
Hardpan, Location of in Relation to City Datum.....	269
Heating and Ventilation, Edited by Fred J. Postel, Mech. Engr.....	279
Hollow Tile Fireproofing, Standard Specifications for.....	239
Illinois Chapter, American Institute of Architects, Officers and Members, List of..	67
Illinois Society of Architects Officers and Committees.....	5
Illinois Society of Architects Officers and Members, List of.....	55
Index to Building Ordinance.....(See Ordinance, Pages 96 to 198)	81
Index to Miscellaneous and Useful Information.....	407
Materials, Strength of.....	267
Miscellaneous and Useful Information Concerning Building Engineering, Trades and Materials.....(See Index, Page 407)	355
Office Practice	73
Plastering, Standard Rules for Measurement and Specifications of.....	341
Plumbers and Plumbing, Code of.....	303
Preface	7
Pricing Extra Work, Revised Basis for.....	354
Reinforcing Bars, Concrete Billet Steel, Standard Specifications for.....	265
Sanitary Code, Sections of Interest to Architects, with Index.....	295
Southern Yellow Pine Timbers, Standard Specifications for.....	349
Special Rulings of Chicago Building Department.....	195
Steel Skeleton Construction, The Design of Wind Bracing in.....	253
Structural Steel, Standard Specifications for.....	261
Subject Index, System of Classification for Filing, Drawings, Plates, Catalogues in Architects' and Contractors' Offices.....	401
Title Page	3
Varnish—Its Manufacture, Use and Application.....	321



THE OAK

An oak tree stood on the river's
brink
And thought—or it did, if an oak
can think—
"It is now two hundred and thir-
teen years
Since the day I entered this 'Vale
of tears',
As an acorn small.
Can it be that all
Two Centuries bring
Is this trifling thing—
To stand and stand on the river's
brink
And at last topple into the flood
and sink!"

"I'm an Oak—and Oak is an hon-
ored name.
I've survived the frost. Wind I've
put to shame.
I'm an Oak—and for toughness,
figure and grain
My ancestral repute I more than
maintain.
And I try to believe
When at last I shall leave
This life, I may go
Where my beauty will show—
Where good Oaks go—not into
boards or floors,
But to trees' own heav'n: Morgan
Perfect doors."

MORGAN SASH & DOOR CO.
CHICAGO

Makers of
Guaranteed Perfect Hardwood Doors

Cornell-Wood-Board

for Walls—Ceilings—Partitions

Guaranteed Not to Warp, Buckle, Chip, Crack or Fall

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